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IN THIS ISSUE

The Use of Monosodium Glutamate in Frozen Foods

Preparation and Evaluation of Dried Citrus Peel as a Pectin Source Material

Production of Pasteurized Frozen Egg Products

Food Planning for Infant Feeding

A Method for Removal of Peel Oil from Citrus Juices and Process Liquids

Effect of Subtilin on Spoilage of Thermal Processed Beef

Certain Partial Ester Emulsifier Levels in Food

Improvements in the Candying of Fruits

Warfarin and Perimeter Rodent Control

Comparison of Frozen and Dehydrofrozen Peas With Fresh and Stored Pod Peas

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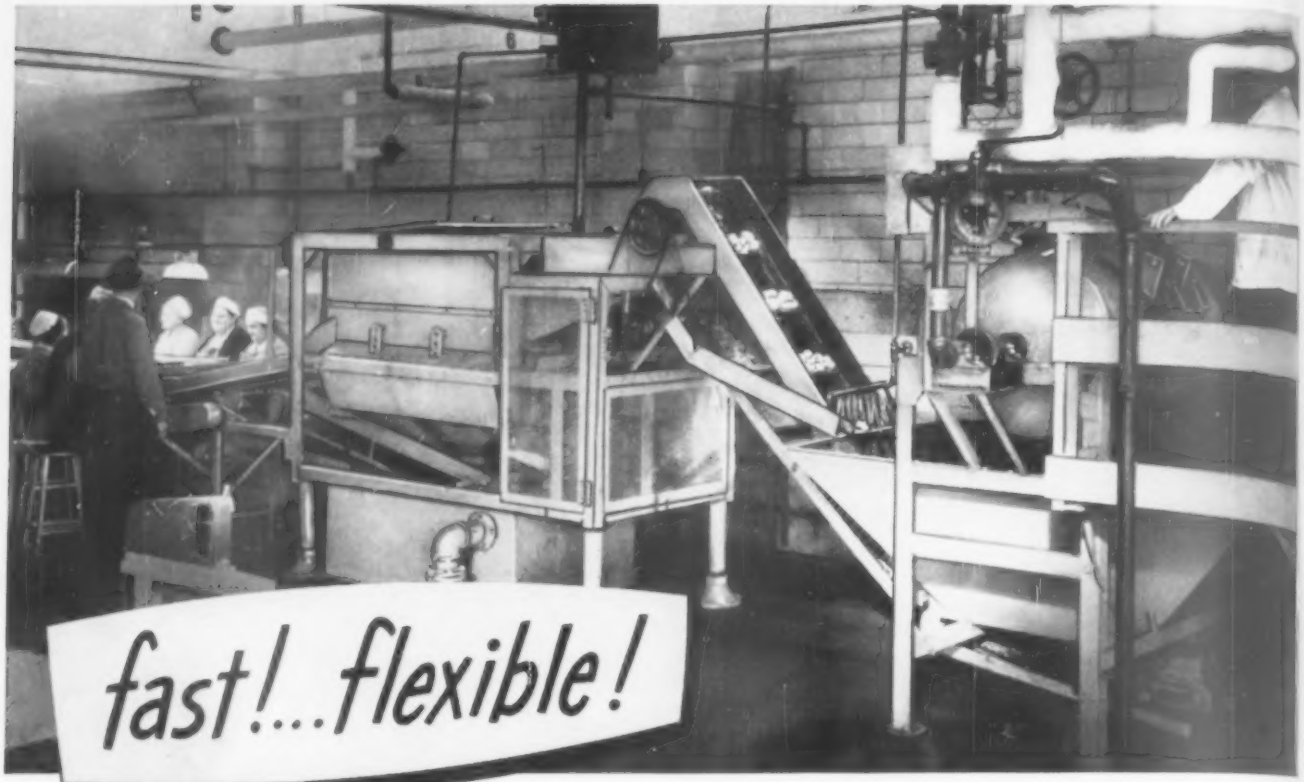

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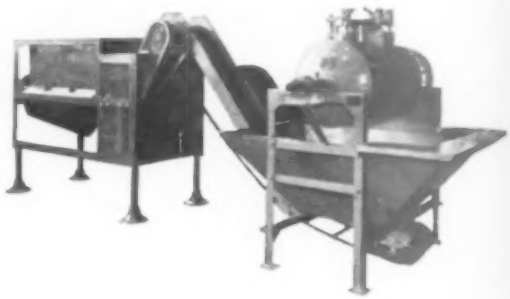

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The Use of Monosodium Glutamate in Frozen Foods[a]

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(Manuscript received June 12, 1952)

The effect of adding monosodium glutamate to various species of fish, to poultry, to beef, pork sausage, hams and bacons and to selected vegetables prior to packaging and freezing is described. The data show that the use of monosodium glutamate in frozen foods under the conditions employed in this investigation prolongs quality during low-temperature storage; an antioxidant effect—particularly with respect to hams, bacon, pork sausage and fatty fish (salmon and mackerel)—was demonstrated organoleptically.

The value of the use of monosodium glutamate to enhance the flavor and improve the acceptability of many canned foods *(1, 2)*, and also as a seasoning in foods prepared in the kitchen for the table *(3, 4)*, has become recognized by the general public as well as by food processors. All are in agreement that most foods become much more flavorful when this comparatively newly developed food ingredient is used in their preparation *(5, 6, 7)*. Now that monosodium glutamate has become a standard ingredient in many canned foods where it is incorporated in the product at the time it is canned, it was only logical to be curious as to the effect it might have on frozen food when the food was treated with it before freezing. Accordingly, an investigation was undertaken to determine the effectiveness of such treatment and to observe this effect on the frozen product during its storage life at low temperatures. Shuey and Eichenberger *(8)* have shown improvement in the acceptability and flavor enhancemnt in certain frozen vegetables by the addition of monosodium glutamate. The present study includes these and other frozen foods evaluated over an extended storage period.

The products investigated were selected from broad fields of frozen foods, *viz.* fish, fresh and cured meat, poultry and vegetables. Included in the list of fish were shrimp, salmon steaks, mackerel, haddock and rosefish fillets. The fresh meat items investigated were ground beef, cube steak and sausage. Cured meats included ham and bacon. The poultry items were broilers, cut up fowl, and turkey, while the vegetable items fairly well covered the whole field now being frozen commercially including asparagus, peas, green and wax beans, corn, baby and Fordhook lima beans, spinach (both leaf and chopped), broccoli, succotash, cauliflower, squash and brussels sprouts.

In all cases samples were selected from production lines during the regular commercial operations so that the samples would represent as nearly as possible commercial practices and procedures, including freezing and storage at both 0° F. and 10° F. (—17.8° and —12.2° C.). During the storage life of the samples, periodic examinations were made visually before cooking and both visually and organoleptically after cooking.

It was the design and intent of the project to observe only visually and organoleptically the results of the use of glutamate at a predetermined average level rather than to attempt to establish optimum concentrations or follow changes by detailed chemical analyses. In all cases a concentration of about 0.15% glutamate was used, since, in general, this amount gave positive flavor enhancement in the types of products investigated.[d]

SERIES I: SEAFOOD

Procedures

Preparation of samples. *Shrimp.* Fresh shrimp from the New York market were peeled, washed and packed without cooking in aluminum foil packages, 12 oz. each. The packages were then frozen on stationary plates in the cold storage at 0° F. (—17.8° C.). After freezing, half of the samples were glazed by brushing the frozen blocks with 25 ml. of an aqueous solution containing 0.5 g. of monosodium glutamate. The other half of the samples, used for controls, were glazed in a similar manner, but with 25 ml. of plain water. All samples were then packed in moisture-proof cellophane bags in cardboard cartons and placed in storage.

Salmon. Silver salmon from the State of Washington were cut into steaks weighing approximately one-half pound each. The control samples were wrapped in cellophane and frozen directly on the freezer plates, while the other steaks were dusted with 0.35 g. of monosodium glutamate, then wrapped and frozen on the plates. Samples were stored at 0° F. and 10° F. (—17.8° and 12.2° C.).

Mackerel. Mackerel fillets were taken from the production line and packed 3 fillets to a package. Half of the samples were wrapped with cellophane and frozen directly while the others were dusted with 0.2 g. of monosodium glutamate per package, then wrapped and frozen. Samples of each were then stored at 0° F. and 10° F. (—17.8° and —12.2° C.).

Haddock. Haddock fillets from the production line, weighing about 14 oz. each, were dusted with 0.6 g. monosodium glutamate, wrapped in cellophane and frozen. Control samples were similarly wrapped and frozen but without treatment with monosodium glutamate. Samples were stored at 0° F. and 10° F. (—17.8° and —12.2° C.).

Rosefish. Rosefish filets were packaged 8 oz. per package after dusting with 0.34 g. of monosodium glutamate. Control samples were packaged without treatment. Samples were then frozen and stored at 0° F. and 10° F. (—17.8° and —12.2° C.).

Testing. The frozen shrimp were cooked by placing the sample while still frozen in a pan containing 2 cups of boiling water and then boiled for 15 minutes. All other samples of fish were allowed to thaw at room temperature, then broiled in an electric oven until crisp and done.

Paired samples were examined at various periodic intervals to determine the effectiveness of the monosodium glutamate

[a] Presented at the Twelth Annual Meeting of the IFT, Grand Rapids, Michigan, June 11, 1952.

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[d] Much credit is due the various companies who cooperated in this project by supplying the product for the storage tests and in whose plants the samples were prepared, *viz.* Armour & Co., Seabrook Farms Co., Atlantic Coast Fisheries Co. and Davis-Cleaver Produce Co.; and to Amino Products Division of International Minerals & Chemical Corp. who suggested and supported the work.

treatment by a trained taste panel with all tests blind.* Table 1 shows in condensed tabular form the results of these storage tests. Since the results at 10° F. (—12.2° C.) storage were of the same general character as those at 0° F. (—17.8° C.) storage

TABLE 1

Comparison of controls with glutamate treated seafood samples held in frozen storage at 0° F. (—17.8° C.)

Months storage time	Control	Glutamate treated
	Shrimp	
1	Excellent somewhat flat taste	Excellent full rounded flavor
5	Very Good b it toughened sl.	Excellent sl. more tender than control
7	Very Good about same as five months	Very Good color sl. brighter than control
14	Fair dry and flat but still edible	Good sweeter, better flavor than control
	Salmon	
1	Excellent color and flavor	Excellent color and full flavor
3	Fair color fading	Excellent color and full flavor
10	Poor dry, flavorless, very poor color	Very Good still bright color good flavor
12	Poor practically colorless very poor flavor	Fair still pink color fair flavor
	Mackerel, Haddock, Rosefish	
1	Very Good	Very Good all preferred to controls
3	Good	Good all preferred to controls
5	Fair to Good old flavor	Good all preferred to controls
9	Poor Mackerel—rancid Haddock—strong off flavor Rosefish—rancid off flavor	Poor Mackerel—still edible Haddock—better than control Rosefish—still good

except that the changes occurred sooner, only those at the lower storage temperature and those tests that showed significant changes are tabulated.

RESULTS AND DISCUSSION

Shrimp. Treating green peeled fresh shrimp with monosodium glutamate after freezing but before frozen storage greatly improved and intensified the flavor, and increased the storage life. The treated samples were sweeter and slightly more tender than the control samples, which appeared to become tougher after 5 months' storage. The color of the treated samples was brighter and retained this brilliance even after 7 months' storage. At the end of 14 months' storage, while no rancidity had developed in any of the samples, the flavor, odor and texture of the glutamate-treated samples were superior to the control samples.

Salmon. Although no difference in color appeared in any of the samples during the first 2 months' of storage, it was noted that there was a definite fading of the color of the control samples at the end of 3 months' storage, whereas the samples treated with monosodium glutamate had retained the pink color of the fresh salmon. At the end of 3 months' storage the glutamate-treated samples were still excellent in flavor, whereas the control samples had begun to lose their fresh flavor. At the end of 10 months' storage the control samples were dry, flavorless and very faded in color, while the glutamate-treated samples had still retained very good flavor, texture and a fair color. After one year in storage pink color and a fair flavor existed in the treated samples, but the control samples had lost their flavor and had become practically colorless.

Mackerel. At the end of 3 months' storage there was no difference noted in the samples except that those treated with glutamate were superior in flavor to the control samples. At the end of 5 months' storage those held at 0° F. (—17.8° C.) were still good in both odor and flavor with the glutamate samples slightly superior in these respects. At the close of the 7-months' test period the same conditions prevailed as at the end of 5 months except that they were somewhat worse; the 0° F. (—17.8° C.) samples had begun to show rancidity. At the end of 9 months' storage the glutamate samples stored at 0° F. (—17.8° C.) were still edible; the control had become rancid. Both control and glutamate-treated samples held at 10° F. (—12.2° C.) were discarded as being too rancid for tasting. At the end of 11 months all samples were discarded.

Haddock. No difference was noted in any of the samples during the first 2 months of storage, except that the flavor of the treated samples was preferred. At the end of 3 months the control samples had become tougher in texture than the treated samples. At the end of 5 months all samples stored at 0° F. (—17.8° C.) were superior in flavor and texture to those stored at 10° F. (—12.2° C.). At the end of 9 months all samples had become strong in odor and flavor and had to be discarded.

Rosefish. At the end of 3 months' storage the glutamate-treated samples at both 0° F. and 10° F. (—17.8° and 12.2° C.) were superior in flavor and texture to the control samples at the same temperatures. At the end of 5 months the 10° F. (—12.2° C.) treated sample appeared to have a slightly better texture than the 0° F. (—17.8° C.) sample. The control samples, while of a good texture, were poor in flavor. At the end of 7 months the 0° F. (—17.8° C.) glutamate sample was superior in flavor and texture with the control samples poor in both respects. At the end of 9 months all 10° F. (—12.2° C.) glutamate samples were discarded as being rancid in flavor and odor, but the samples held at 0° F. (—17.8° C.) were still good. The control samples at both temperatures were poor in all respects and discarded. At the end of 11 months the treated samples had become rancid and were discarded.

* The panel was usually composed of five or six experts trained in testing the products under examination; care was exercised to preclude the panel's receiving any information in advance of the tests that might influence their judgment. The panel was asked to evaluate by visual and organoleptic criteria the samples submitted to them.

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SERIES II: MEATS

Procedures

Preparation of samples. *Bacon.* Pork bellies from regular production were cured in accordance with regular procedure. The pork bellies were chilled for 5 days and sufficient paired bellies were obtained to fill 2 standard curing boxes, each holding 615 pounds. One lot was rubbed with dry cure containing 24.41 pounds of regular salt cure mixture and 1.17 pounds of monosodium glutamate. The other 615 pounds of bellies were treated with 24.41 pounds of the regular salt mixture according to the usual practice. Both lots of bacon were cured according to standard practice, and were then packaged for storage testing.

Each slab of bacon was cut into three pieces for storage at three different temperatures, 0° F., 10° F. and 34° F. (—17.8°, —12.2°, and 1.2° C.). Each piece was carefully wrapped with cellophane and then placed in an outside stockingette. Corresponding pieces of the slabs were marked and were tested for comparison after storage at the different temperatures.

Ham. Nineteen pairs of fresh hams, each ham weighing 12 to 14 pounds, were obtained from the warm carcasses, numbered and marked "left" and "right" for identification purposes. While the hams were still warm, a 1.5% solution of monosodium glutamate in the standard pickle or brine was pumped into the main artery of each left ham. Each of the right hams was similarly artery-pumped with the same weight of the standard pickle or brine, which, however, did not contain any monosodium glutamate. In both cases the amount of pickle added was 10% of the weight of the fresh ham, the hams being placed on accurate scales and the pickle pumped in until the weight of the ham increased 10%. The hams were then cured and smoked in accordance with standard Armour practice.

Upon arrival at the laboratory, the hams which were to be stored at 10° F. (—12.2° C.) were sawed in half and then wrapped in cellophane and inserted in a stockingette. The other hams which were to be stored at 34° F. (1.2° C.) and 0° F. (—17.8° C.) were left whole and wrapped in cellophane and stockingette for storage.

Ground beef. Top round steak was dusted with 0.15% of its weight with monosodium glutamate and then put through a commercial grinder. The ground beef was then carefully mixed and packaged in Reynolds "Pak" aluminum containers, each containing 14 oz., frozen and stored. The control samples were prepared the same way except that no monosodium glutamate was added.

Cube steaks. Top round steak of choice grade was cut into 8-oz. pieces and then cubed. One half of the pieces were dusted with monosodium glutamate and the other half were left untreated. All samples were wrapped in cellophane, placed in a tray container and then overwrapped with cellophane, frozen and stored.

Sausage. Fresh pork butts from the market were ground fine, the spices and seasoning being ground into the meat at the market. Monosodium glutamate was added to the formula for one half and left out of the formula for the control samples. The following is the formula containing monosodium glutamate.

For each pound of ground pork—

.68 g. monosodium glutamate
1.80 g. salt
1.20 g. sage (green)
.8 g. white pepper

The spices were mixed together and added to the ground pork, then the sausage was packaged, 14 oz. each, in Reynolds "Pak" containers, sealed, labeled, frozen and placed in storage.

Testing. All samples of meat to be tested were thawed at room temperature before cooking. The ground beef was made into 4-oz. patties and carefully broiled, done on the outside and medium rare on the inside. The cubed steaks were broiled to the same doneness as the ground beef. The sausage was made into patties and then broiled to a well-done stage. The bacon was sliced from the slab and broiled. Center slices of the thoroughly defrosted ham were also broiled.

Table 2 shows in condensed tabular form results of storage at 0° F. (—17.8° C.) since flavor differences between control and glutamate-treated samples were more pronounced over the longer storage period at this storage temperature. Similar results occurred at the higher storage temperatures but in a much shorter time.

TABLE 2

Comparison of control with glutamate treated meat samples held in frozen storage at 0° F. (—17.8° C.)

Months storage time	Control	Glutamate treated
	Bacon	
1	Very Good	Very Good
4	Good very sl. rancid	Very Good
7	Fair sl. rancid	Good no rancidity
10	Poor very rancid	Poor stale flavor but no apparent rancidity
	Ham	
1	Very Good	Very Good preferred to control
4	Good	Good preferred to control
9	Fair sl. stale flavor, color faded	Good still full flavored
14	Rancid	Fair still quite satisfactory
	Ground Beef and Cube Steak	
1	Very Good	Very Good flavor preferred to control
6	Good	Very Good flavor preferred to control
8	Fair lacks freshness	Good much more flavorful than control
10	Poor	Fair
12	Very Poor flat, stale, old flavor	Poor stale flavor but preferred over control
	Pork Sausage	
1	Very Good	Very Good more flavorful than control
3	Fair flat in flavor	Good more flavorful and tender
5	Poor sl. rancid	Good no rancidity
7	Very Poor rancid and color faded	Fair sl. old flavor
9	Very Poor very rancid	Fair poor flavor but not rancid

RESULTS AND DISCUSSION

Bacon. At the end of one month of storage there was little or no difference between the treated and control bacon samples at all 3 storage temperatures. At the end of 3 months' storage the 0° F. (—17.8° C.) untreated sample was preferred but the treated samples held at the other 2 temperatures were preferred over the controls. At the end of 4 months the 34° F. bacon samples, both treated and untreated, were moldy on outside with a slight off-flavor in the control sample. In

the 0° F. (—17.8° C.) samples a slight rancid flavor appeared in the control and so the treated sample was much preferred. At the end of 5 months all 34° F. (1.2° C.) samples were discarded, the surface being very moldy and texture unsatisfactory. At the end of 7 months the treated samples at 10° F. (—12.2° C.) were much preferred to the control samples. There was a slight rancidity in both control samples at the end of this period. At the end of 9 months' storage the treated bacon samples at 10° F. and 0° F. (—12.2° and —17.8° C.) were still not rancid as was the control. At the end of 10 months' storage the treated samples still were not rancid at either the 10° F. or 0° F. (—12.2° and —17.8° C.) temperatures. However, the color and flavor were poor and the samples had passed their usefulness in testing. The control samples were very rancid at both storage temperatures.

One set of samples was kept in storage for 14 months at 0° F. (—17.8° C.). The treated samples, although poor in color and flavor, was still edible on the inside. The control sample was rancid all the way through.

Ham. At the end of one month all glutamate-treated ham samples stored at the 3 temperatures, 34° F., 10° F., and 0° F. (1.2°, —12.2°, and —17.8° C.) were superior in flavor, color and texture to the control samples. At the end of 3½ months the treated sample and control sample at 34° F. (1.2° C.) were very moldy on the outside and gave off a rancid odor in cooking. The 34° F. (1.2° C.) samples were discarded at the end of 5½ months. The 10° F. and 0° F. (—12.2° and —17.8° C.) treated samples at the end of 7 months were juicy and flavorful. The 10° F. (—12.2° C.) treated sample was preferred over the 0° F. (—17.8° C.) sample as being slightly more tender. There was a slight rancid flavor in both of the control samples when tested at this time. This same condition prevailed throughout the testing until the end of 10 months' storage. At the end of 11 months' storage the treated ham samples at 0° F. and 10° F. (—17.8° C. and —12.2° C.) were not rancid but had lost the full flavor and color of first tested samples. Rancidity was evident in both control samples at the end of this time.

One set of samples remained in storage at 0° F. (—17.8° C.) for 14 months. Although this treated sample was slightly bleached in color, the flavor was fairly good and it was edible. The control sample, however, was also bleached out in color but so rancid that it was not edible.

Ground beef. The treated samples at both temperatures were superior in flavor to the control samples at the end of one month. At the end of 2 months the treated sample stored at 10° F. (—12.2° C.) was superior in flavor and texture to the 0° F. (—17.8° C.) treated sample or to the control sample at either temperature. The same condition prevailed at each testing until after 8 months had elapsed. At the end of 8 months the control sample had acquired an old stale flavor. The 10-months' test showed that the glutamate-treated samples at both temperatures were superior in flavor to the control, but there was little if any difference between the treated samples at 0° F. and 10° F. At the end of 12 months all samples, both glutamate-treated and control, were discarded because of flat, stale flavor.

Cube steak. The same condition was observed in all samples of cube steak as described for ground beef. It was interesting to note that in each case the 10° F. (—12.2° C.) sample was juicier and more tender than those held at 0° F. (—17.8° C.). At the end of 12 months all samples were discarded as they had become stale and flat in flavor.

Sausage. At the end of one month's storage the glutamate-treated samples at both temperatures were preferred over the control sample. At the end of 2 months' storage the treated sample at 0° F. (—17.8° C.) storage was preferred over the 10° F. (—12.2° C.) sample and the control sample. The control sample was lacking in color and was slightly tough. At the end of 3 months' storage the 10° F. (—12.2° C.) treated sample was superior in flavor to the 0° F. (—17.8° C.) treated sample, while the control samples possessed a flat flavor and were not as acceptable as the treated samples. At the end of 5 months the 0° F. (—17.8° C.) treated sample was preferred over the 10° F. treated sample while the 10° F. (—12.2° C.) storage control sample was slightly more rancid than the 0° F. (—17.8° C.) control sample. At the end of 7 months of storage the 10° F. (—12.2° C.) treated sample was more tender than the 0° F. (—17.8° C.) treated sample. The control samples at the end of this time had lost all their fresh natural color and were rancid in flavor. The treated samples too had started to fade in color but the fading was not as pronounced as in the control samples. At the end of 9 months the 0° F. (—17.8° C.) treated sample was still edible, not rancid, but not the good sweet flavor found in previous tests. The treated sample stored 10° F. (—12.2° C.) was slightly rancid in flavor. The control samples were definitely rancid in flavor and the color in all samples was definitely faded and gray. At this time all samples were discarded as being no longer useful for further testing.

SERIES III: POULTRY

Procedures

Preparation of samples. *Fowl.* Freshly dressed eviscerated fowl, about 4 pounds each, were treated with monosodium glutamate by 3 different methods before freezing as follows: while still somewhat warm, 11 of the fowl were stitched with an aqueous 5% solution of monosodium glutamate, each bird receiving 5% of its weight of the solution, using a recirculating stitching pump to force the solution through the stitching needle and into the tissues. The monosodium glutamate solution was injected into each leg, each thigh and on each side of the breast, each carcass receiving six injections. If this stitching did not increase the weight by 5%, additional stitching was done to bring the weight to the desired level. Eleven fowl were similarly stitched with a 5% solution of monosodium glutamate in homogenized milk. Eleven fowl were chilled overnight with crushed ice, then dusted in the visceral cavity, using a salt shaker, with monosodium glutamate up to 0.25% of the weight of the bird. Eleven fowl of the same lot and which had been chilled overnight were not treated but used as control samples.

The dusted fowl and the control samples were disjointed immediately and packaged in Waldorf type cellophane-lined waxed cartons containing a cellophane window on the top face of the carton. The cartons were not overwrapped. The fowl that had

been stitched with the milk and aqueous solutions of monosodium glutamate were chilled overnight with crushed ice and then disjointed and packed the same as the dusted and control samples.

The fowl samples were then frozen and stored at 0° F. (—17.8°C.).

Broilers. Freshly killed and eviscerated broilers were treated with monosodium glutamate by the same 3 methods before freezing as in the case of the fowl. Eight were stitched with a 5% aqueous solution of monosodium glutamate up to 5% of their weight. Eight others were stitched with homogenized milk containing 5% monosoduim glutamate up to 5% of their weight. Seven others were chilled overnight with crushed ice. Next morning monosodium glutamate was dusted into the visceral cavity of each chicken using a salt shaker, each one receiving 0.25% of its weight in monosodium glutamate. Seven other chickens from the same lot were retained for control samples and received no treatment.

All samples were wrapped in moisture vapor proof cellophane, placed in stockingettes, frozen and stored at 0° F. (—17.8° C.).

Turkey. Eight turkeys, weighing approximately 22 pounds each after dressing, were eviscerated and cut in two by sawing down the backbone. The halves were numbered and marked R (right) and L (left). While still somewhat warm, the right sides were stitched with a 5% solution of monosodium glutamate in homogenized milk until the weight of the half turkey had increased 5%. The turkeys were then chilled by packing in crushed ice overnight after which the 2 halves of each turkey were placed back together and the whole bird inserted in a "Cryovak" bag which was evacuated, shrunk and sealed, frozen and placed in a fiberboard container. The turkeys were then stored at 0° F. (—17.8° C.).

Testing. All samples of fowl, broilers and turkeys were allowed to thaw completely at room temperature before cooking. The samples of defrosted fowl were stewed separately. The broilers were brushed with a vegetable shortening and broiled in an electric oven until brown and, when pierced with a fork, no juices ran. The turkey halves were rubbed with salt, wrapped in aluminum foil and baked (roasted) in a 350° F. preheated oven, allowing 25 minutes to the pound. During the last half hour of baking, the aluminum covering was removed to allow the turkey to brown.

Coded samples of all of the poultry were examined every 2 months by a trained taste panel with the results reported in Table 3.

RESULTS AND DISCUSSION

Fowl. At the end of second month fowl stitched with milk containing glutamate was perferred as to color, odor, flavor and texture over all other samples, with the water-glutamate solution stitched sample ranking second. The control ranked last but had a very good flavor. The samples ranked in the same order during the first 9 months' storage, but at the end of 11 months a slight rancidity and loss of full flavor had occurred in the milk stitched fowl. At this point the water stitched sample, while it showed some loss of fresh flavor, was superior to both the milk stitched and dusted samples. All glutamate-treated samples were preferred to the control. At the end of the 12-month storage period, the control sample was slightly stale in flavor but without rancidity, whereas rancidity occurred in both the dusted and milk stitched samples. At this point the water stitched sample was very much superior in flavor to all other samples and no rancidity was evident.

Broilers. Throughout 11 months of storage at 0° F. (—17.8° C.) the samples ranked as follows, the milk-glutamate solution stitched samples having a superior flavor, sweetness and tenderness:

TABLE 3

Comparison of controls with glutamate treated poultry samples held in frozen storage at 0° F. (—17.8° C.)

Months storage time	Control	Glutamate stitched milk soln.	Glutamate dusted in cavity	Glutamate stitched water soln.
		Fowl		
1	Very Good poorest	Excellent preferred	Excellent 3rd choice	Excellent 2nd choice
9	Very Good poorest	Excellent preferred	Excellent 3rd choice	Excellent 2nd choice
11	Fair flavorless	Fair 2nd choice	Fair 2nd choice	Fair preferred
12	Poor stale	Poor sl rancid	Poor sl. rancid	Fair no rancidity
		Broilers		
1	Very Good poorest	Excellent preferred	Excellent 3rd choice	Excellent 2nd choice
11	Good poorest	Good preferred	Good 3rd choice	Good 2nd choice
12	Fair poorest	Fair 2nd choice	Fair 3rd choice	Fair preferred
		Turkeys		
1	Very Good	Excellent superior in flavor, juiciness and tenderness		
5	Very Good	Excellent superior in flavor, juiciness and tenderness		
6	Very Good	Very Good less difference		
9	Good	Good little if any difference in preference		

No. 1—Stitched with milk containing monosodium glutamate.

No. 2—Sitched with water containing monosodium glutamate.

No. 3—Dusted in visceral cavity with monosodium glutamate.

No. 4—Control (no treatment).

At the end of 12 months the milk stitched sample had lost some of its flavor and became second choice; however, no rancidity was evident in any of the samples. The ranking at this point was:

No. 1—Stitched with water containing monosodium glutamate.

No. 2—Stitched with milk containing monosodium glutamate.

No. 3—Dusted in visceral cavity with monosodium glutamate.

No. 4—Control (no treatment).

Turkeys. During the first 5 months of storage at 0° F. (—17.8° C.) the sample stitched with milk containing glutamate was superior in flavor, juiciness and tenderness to the control or untreated side. At 6 months it was noted that the distinct difference noted in the previous tests had begun to disappear, but the milk-stitched sample was still preferred. At the end of 11 months, while no rancidity was evident, the difference between the control and treated side had disappeared and no preference could be noted.

SERIES IV: VEGETABLES

Procedures

Preparation of samples. *Asparagus.* Native Connecticut asparagus was cut to size and steam blanched for 3 minutes, chilled in running cold water, drained and packaged in 12-oz. folding cartons, then overwrapped with cellophane. Approximately 6 oz. of asparagus spears were placed in the carton, then sprinkled with 5 ml. of a monosodium glutamate solution; the remaining 6 ounces were placed with the spears running in the opposite direction and sprayed with another 5 ml. of the above solution. The center cuts and open spears were cut in desired sizes, steam blanched, weighed, and sprinkled as above with the glutamate solution, then wrapped as above. Control samples were packaged for comparison in testing without treatment. All samples were then frozen and stored at 0° F. (—17.8° C.).

Peas. The blanched peas were weighed up in 5-pound lots, dusted with 0.15% of their weight with monosodium glutamate. They were well stirred and mixed so that the glutamate would be well distributed throughout the peas. They were then packaged in 10-oz. cartons and overwrapped and frozen. The control samples were given no treatment. All vegetable samples were stored at 0° F. (—17.8° C.) only.

Whole kernel corn. Freshly blanched yellow kerneled corn, cut from the cob, was used for this experiment. The monosodium glutamate was dusted on the wet corn. Fifty-ounce batches were weighed up and dusted with 0.15% of their weight with glutamate. The glutamate was well stirred in and then packaged in 10 oz. Marathon cartons, then overwrapped, frozen and stored at 0° F. (—17.8° C.).

Frozen baby lima beans. The blanched limas were weighed up into 50-oz. lots and dusted with 0.15% of their weight in glutamate. They were then well stirred to distribute the glutamate evenly. The treated limas were then packaged in 10-oz. Marathon cartons and then overwrapped. The samples were then frozen and stored at 0° F. (—17.8° C.).

Succotash. The succotash was processed and packaged by the same procedure used in the freezing of baby lima beans. The pack was made up of 60% baby limas and 40% corn. It was also stored in the same manner.

Fordhook lima beans. The blanched Fordhooks were treated in the same manner as were the baby lima beans.

French cut green beans. The blanched frenched beans were weighed up in 50-oz. lots, dusted with 0.15% of their weight in monosodium glutamate. They were then carefully stirred so as to distribute the glutamate evenly. The treated frenched beans were then packaged in folding Marathon cartons, labeled, overwrapped, frozen and stored at 0° F.

Cut wax beans. The same procedure was used in the packing of the wax beans as was described for frozen frenched green beans.

Cut green beans. The same procedure was employed in the freezing of green beans as that used in freezing the frenched green beans and the cut wax beans.

Leaf spinach. The spinach was treated with monosodium glutamate by spraying 70-oz. lots of blanched spinach with 10 strokes of a 50-gram monosodium glutamate to 1000 ml. water solution. By careful calculation this was found to be comparable to 0.15% dry glutamate used in other vegetable experiments. The blanched spinach was treated first on one side, then turned and treated on the other. The spinach was then packaged in 12 oz. Marathon cartons, overwrapped, frozen and stored at 0° F. (—17.8° C.).

Chopped spinach. The same method was used in packaging the chopped spinach as that used in packaging leaf spinach.

Cauliflower. The cauliflower was treated by spraying it with 10 shots of a 50 g. of monosodium glutamate to 1000 ml. water solution per 70 g. of blanched cauliflower. This is comparable to the 0.15% dry glutamate used in other vegetable experiments. The cauliflower was then packaged in Marathon cartons, overwrapped, frozen and stored at 0° F. (—17.8° C.).

Broccoli. The same method of treating, packaging, freezing and testing was used in freezing broccoli as was used in the freezing of cauliflower.

Brussels sprouts. The same method of processing the blanched brussels sprouts was used as that employed in the freezing of cauliflower and broccoli.

Squash. Freshly prepared Boston Marrow Squash was taken from the processing line, was weighed up in 70-oz. lots and thoroughly mixed with 2.5 g. of monosodium glutamate (0.5 g. per 14 oz. of squash), packaged 14 oz. to the package, in Marathon cartons, overwrapped, frozen and stored at 0° F. (—17.8° C.).

Testing. All vegetable samples when tested were cooked in accordance with accepted directions for each product. For example, in general the package of frozen vegetable was dropped into one-half cup of boiling water containing one-half teaspoon of salt and boiling continued for the length of time required for the vegetable being tested. Immediately after cooking the vegetables were drained and tasted without any additional seasoning. In the case of squash the frozen block of squash was placed in the top of a double boiler and heated over boiling water until thoroughly thawed and ready for tasting. One-half teaspoon of salt was added to each package after thawing.

RESULTS AND DISCUSSION

The flavor of all glutamate-treated vegetables was preferred to the control samples. The preference noted at the first month examination has carried through the 10 months the project has been running with the difference more apparent as the storage period progressed. The glutamate seems to produce a sweet, rounded flavor in the vegetables that is not found in the control samples. Glutamate-treated frozen peas were superior in color and flavor to the control samples at the end of 10 months' storage. The treated samples also appeared more tender. In the treated green vegetables—such as broccoli, peas, green beans and spinach—the green color was more brilliant than it was in the control samples. This color was retained during the 10-month storage period and through subsequent cooking. The color and flavor of treated asparagus was also superior to the control samples. In the case of yellow vegetables, the flavor was enhanced and improved.

SUMMARY AND CONCLUSIONS

Addition of monosodium glutamate to many foods prior to packaging and freezing greatly improves their flavor and acceptability which, in general, becomes more evident during frozen storage. In many instances color also is improved by addition of glutamate.

The pink color of fresh frozen salmon seems to be retained by the use of monosodium glutamate, whereas without such a treatment the pink color is bleached out after a very short time in freezing storage.

Frozen green peeled shrimp treated with glutamate have a brighter color, improved sweeter flavor, and are more tender after cooking than when glutamate is not used.

Other fish such as mackerel, haddock and rosefish treated with monosodium glutamate have a finer flavor for a longer period in frozen storage than the same varieties where glutamate is not used.

All poultry has an improved flavor, is juicier and of better texture where glutamate has been used in their preparation for freezing storage.

Beef, pork sausage, hams and bacon have been much improved in flavor and texture by the use of monosodium glutamate before freezing. These meats as well as fish and poultry have retained their original high quality for longer periods in freezing storage than when glutamate is not used.

Monosodium glutamate added to vegetables before freezing effects a full rounded-out sweet flavor and seems to minimize the raw flavor usually encountered. Color also is improved by the use of glutamate.

The use of monosodium glutamate in frozen foods as described has seemingly prolonged the period of high quality during storage at low temperatures and has demonstrated, organoleptically, that glutamate has some properties of an antioxidant. This point was demonstrated particularly in its effect on hams, bacon, sausage and fatty fish, such as salmon and mackerel.

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Preparation and Evaluation of Dried Citrus Peel as a Pectin Source Material

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A process for preparing dried citrus peel as a pectin source material is described. Conditions for blanching, counter-current-washing, drying, and storing, and their effects on the quality of the pectin contained in the peel, are presented. Properly prepared dried peel is stable and shows promise as a source material for pectin production.

Need for a stable source material for pectin became apparent when work was undertaken at this Laboratory to prepare citrus pectin extracts for use in pilot plant studies of the production of low-methoxyl pectin. The location of the Laboratory, away from citrus processing areas, made it desirable to find means for preserving the pectin content of the fresh peel to make it conveniently available over an extended period.

A dried citrus peel meeting these requirements also merits consideration for use in the commercial production of pectin. With fresh peel, which is highly perishable, pectin production operations must be geared to citrus processing operations on a seasonal basis. Dried peel of suitable quality would eliminate these limitations.

Present practices of drying citrus peel for stock feed include treatment with lime, followed by pressing and drying. Liming, and the drying methods employed, destroy the pectin as a jellying agent and render the peel useless as a source of pectin.

A limited amount of dried citrus peel has been prepared commercially as a pectin source material. The quality of pectin found in samples of these dried peels was considerably below that native in the same type of fresh peel. From this fact and preliminary attempts to dry peel, it was recognized that the method for preparing a dried citrus peel required study.

In addition to establishing methods for preparing high-quality dried peel, methods for evaluating the quantity and quality of pectin therein were needed. Available methods were found to be unsatisfactory for our purposes. The methods developed in this study have been made more generally applicable and published *(4)*.

EVALUATION OF CITRUS PEEL

Determination of pectin content. Two hundred grams of fresh peel (or 50 g. of dried peel presoaked for 3 to 4 hours in water) is comminuted with 2,000 ml. of water in an electrically operated blender in several portions. The slurry is adjusted to a pH of 1.8-1.9 with sulfuric acid, heated, and held at 205 ± 4° F. (96 ± 2° C.) for 30 minutes with vigorous stirring. At the end of the extraction period, the net weight is adjusted to 2,200 g. (2,050 g. for dried peel), 1% filter aid and 1% paper pulp are added, and the slurry is filtered on a filter-aid-precoated Büchner funnel. Twill cloth is used to support the precoat. The first portion of filtrate is rejected (to eliminate unknown dilution from the filter) and the remainder is collected and cooled under running water.

The pectin content of the solution is measured by an optical rotation method *(2)* with 230° as the value for the specific rotation of pectin.

The pectin content of the peel is calculated by the following formula:

$$\text{Pectin content of peel (\%)} = \frac{[\text{Pectin content of sol (\%)}]\left[(\text{net wt. of batch}) - \frac{(\text{wt. of peel})\ (\text{solids content of peel, \%})}{100}\right]}{\text{wt. of peel}}$$

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Determination of pectin quality. A mild extraction technique is used for this analysis to remove the pectin contained in the peel as little changed as possible. Fifty g. of dried peel or 500 g. of fresh peel is mixed into one liter of water containing 2 ml. of concentrated sulfuric acid. A few milliliters of toluene are added as a preservative. The samples are covered, allowed to stand for 72 hours, and stirred two or three times during this period. After 24 hours the pH is checked and if necessary adjusted to 1.7 ± 0.1.

The solution is separated by draining the slurry on cheesecloth and is further clarified by mixing in 1% filter aid and filtering it through a Büchner funnel prepared as described in the previous section.

The pectin content of the solution is determined by optical rotation. The solution is diluted quantitatively by weight to a pectin concentration of approximately 0.1%. At the same time, sodium chloride and sodium hexametaphosphate are added in the amounts of 0.6% and 1.0%, respectively, in the final solution, and dilute sodium hydroxide is added to adjust the final pH to 6.0 ± 0.2 *(1, 3)*. The efflux time of the solution is determined in a calibrated capillary-type viscometer at 77° F. (25° C.).

The intrinsic viscosity of the pectin, $[\eta]$, is calculated with the following formula:

$$[\eta] = \frac{2.3 \log \eta_r}{C}, \text{ where } \eta_r = \frac{t_1}{t_2}$$

where η_r is the relative viscosity; t_1, efflux time for the solution; t_2, efflux time for the solvent; and C, concentration of pectin in the solution (wt./wt.%). This formula for $[\eta]$ is an approximation and true only in the limit as the concentration approaches zero, but is satisfactory for making comparisons. In the formula for η_r, the density terms ordinarily used are omitted, since the densities of water and 0.1% pectin solutions differ less than the limit of error of the method as employed here.

Determination of moisture content. Loss in weight of ground peel dried 18 hours in a forced-draft oven at 150° F. (65.5° C.) is calculated as moisture.

TESTS OF THE PREPARATION OF DRIED CITRUS PEEL

Blanching and water washing. Fresh citrus peel contains a pectic enzyme which must be inactivated if the quality of the pectin is to be preserved. This is best accomplished by blanching. Water washing of citrus peel has been employed in studies at this Laboratory on the extraction of pectin. Washing removes soluble solids, some of the pigments and glycosides, and the colloidal solids introduced by the cutting of the peel. Removal of these materials makes filtration of the extract easier and produces a lighter-colored, more nearly tasteless final product. Water washing has additional advantages if the peel is to be dried. It makes the drying easier by the removal of sugars, and increases the amount of pectin in proportion to total solids, thereby reducing the weight of material to be stored.

Countercurrent method. A small-scale countercurrent washer, consisting of a trough 12 feet long and 6 inches wide with a semi-cylindrical bottom, was fitted with an interrupted flight screw throughout its length. A ramp and drag were provided for discharging peel at one end. At the other end, steam was injected over a two-foot section to maintain a water temperature of 185-194° F. (85-90° C.). Freshly-cut peel was introduced into this section to accomplish blanching and was conveyed by the screw through the trough. Water was introduced at the opposite end and flowed counter to the peel and out an overflow pipe.

Valencia and Navel orange and grapefruit peels were successfully washed in this unit. The fresh peel was cut into slices between $\frac{1}{8}$ and $\frac{3}{16}$ inch thick in a standard kraut cutter which discharged directly into the peel washer. Three weights of water per weight of peel and a total retention time of 30 minutes, of which about 5 minutes was at the elevated temperature, were sufficient to give a peel which would produce a readily filterable pectin extract of good clarity. The grapefruit peel was almost tasteless, indicating substantial removal of the bitter constituent (naringin).

A larger model of this washer with an interrupted screw 12 inches in diameter and 12 ft. long was installed in a field pilot plant. Valencia orange peel was washed successfully in this unit at a capacity of 400 lbs. per hour. The washed peel was dewatered in a small belt press to a solids content of 12 to 14%. Peel was retained in the belt press for about 1 minute, and was subjected to a maximum and final pressure of not more than 5 pounds per square inch.

Batch method. While not recommended over the countercurrent method, a batch method was employed for the blanching and washing of peel samples used for the drying experiments. This was necessary because of the small capacity of the laboratory countercurrent washer.

The peel was blanched in perforated metal baskets submerged in boiling water for two minutes. The blanched peel was plunged immediately into a large volume of cold water to effect rapid cooling. The peel was washed in running water for two 30- to 45-minute periods, with fresh water used each period. Finally the peel was drained and pressed in an hydraulic bag press. Using conventional procedures, the peel was easily pressed without substantial loss of pectin to a solids content of 14 to 16%. Further pressing resulted in a loss of pectin. Peel of equal quality to that produced by countercurrent washing was obtained, but a considerably larger ratio of water to peel was required.

DRYING

Using a single drying temperature. Portions of batch-washed peel were dried at 4 different temperatures in a forced-draft oven on perforated-bottom metal trays loaded ¾ pound per square foot. Samples of peel were taken at various points throughout the blanching and washing operation as well as after drying. The pectin contents and intrinsic viscosities of the pectin in the peel samples were determined. Results are given in Table 1. Solids contents were run only to correct pectin contents to a moisture-free basis. The dried materials were all below 8% moisture, except that dried at 75° F. (24° C.), which contained 12% moisture.

TABLE 1

Pectin content and intrinsic viscosity of peel samples using a single drying temperature

Description of sample	Pectin content moisture-free basis %	Intrinsic viscosity $\left(\frac{dl}{g}\right)$
Fresh Peel—untreated	21.7	9.5
Blanched and washed	26.3	8.3
Dried at 75° F., 18 hrs.[b]	27.7	8.3
Dried at 130° F. (54.5° C.), 5 hrs.	28.2	7.9
Dried at 165° F. (74° C.), 2¼ hrs.	28.0	7.0
Dried at 200° F. (93.5° C.), 2 hrs.	25.6	5.6
Dried at 200° F. (93.5° C.), 4 hrs.	26.3	4.5

[b] Air circulation only. No heat.

Using two-temperature drying. Batch-washed peel was dried at 200° F. (93.5° C.) for 35 minutes in the same manner as described previously. This sample was stored overnight in a covered vessel for moisture equilibration so that uniform batches could be obtained for finish drying. This partially dried peel was finished at 130° F. (54.5° C.), half for a 30-minute period, the other half for 3½ hours.

Another portion of the same batch-washed peel was stored overnight (16 hours) at 75° F. (24° C.) and dried in the manner described previously for 20 minutes at 200° F. (93.5° C.), followed by one hour at 130° F. (54.5° C.). As the pectin content of the peel does not vary significantly during drying as shown in the previous experiment, pectin contents were not determined on these samples. The moisture content and intrinsic viscosities of the pectins are given in Table 2.

Stability of pectin in dried Valencia orange peel. To prepare material for experimental use, peel from about one ton of

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TABLE 2

Intrinsic viscosity and moisture content of peel samples using two-temperature drying

Description of sample	Intrinsic viscosity $\left(\frac{dl}{g}\right)$	Moisture content %
Blanched, washed, and pressed peel	9.3	84.4
Dried 35 min. at 200° F. (93.5° C.)	7.5	11.2
Followed by 30 min. at 130° F. (54.5° C.)	7.0	7.5
Followed by 3½ hr. at 130° F. (54.5° C.)	6.5	2.4
Blanched, washed, and pressed peel held 20 hrs. at 68° F. (20° C.)	9.1	
Dried 20 min. at 200° F. (93.5° C.)		
Followed by 1 hr. at 130° F. (54.5° C.)	8.2	5.0

Valencia oranges was cut, blanched, washed, and pressed by the batch process. The peel was dried in the manner described previously for 15 minutes at 200° F. (93.5° C.), then one hour at 130° F. (54.5° C.) and finished by 15 minutes of air circulation to cool the material rapidly. One hundred and forty-one pounds of dried peel was obtained.

The intrinsic viscosity of the pectin from the wet-pressed peel was 10.8 dl/g. and that of the final dried peel 9.3 dl/g. The dried peel contained 16.2% moisture and 31% pectin (moisture-free basis).

The change in the intrinsic viscosity of pectin contained in the large batch of dried Valencia orange peel has been followed on samples stored in friction-top cans at room temperature and at 100° F. (38° C.). The data are shown in Table 3.

TABLE 3

Changes in intrinsic viscosity of pectin contained in dried Valencia orange peel stored at room temperature and at 100° F. (38° C.)

Storage time *(months)*	Intrinsic viscosity (dl/g) Sample stored at	
	Room temp.	100° F. (38° C.)
0	9.3	
1	9.3	8.2
2	8.9	7.3
3	8.6	7.1
16	8.3	2.7

DISCUSSION

Blanching of the peel is necessary to inactivate the pectic enzymes. Quality loss was not excessive when a 3-minute blanch at 212° F. (100° C.) was used. However, this is a more drastic treatment than is required. Ten seconds in water at 194° F. (90° C.) inactivated the enzymes provided the peel was cut fine (about 8-mesh) and agitated during the blanching period.

Data in Table 1 show that under constant temperature conditions the quality of pectin in dried orange peel decreases as the drying temperature increases. In Table 2 it is shown that more rapid drying with comparable retention of pectin quality can be accomplished by drying the peel at a relatively high temperature for a short period of time, and finishing the drying at a reduced temperature. Under these conditions, evaporative cooling keeps the peel at a safe temperature during the high-temperature portion of the drying. Since the peel temperature approaches the air temperature as drying proceeds, the air temperature must be decreased during the drying to minimize degradation of pectin in the peel.

It is shown in Table 2 that peel can be dried initially at 200° F. (93.5° C.) for not more than 20 minutes, and then finish dried at 130° F. (54.5° C.), with good retention of pectin quality. It is important that the average moisture content of the peel not fall below about 30% during the initial high-temperature drying, and that finish drying be stopped when the equilibrium moisture content, in the range of 10 to 16%, is reached. The initial drying probably can be accomplished more uniformly in a shorter time by the use of a rotary drier. Final drying temperatures below 130° F. (54.4° C.) are helpful in minimizing pectin degradation, but are impractical in tray drying. Finish drying in bins, however, would permit use of lower final drying temperatures.

A refinement in operation introduced in the preparation of the large batch of dried peel was the use of a 15-minute cooling period following the drying. This is important, for, if the material is sacked or placed in drums at a high temperature, cooling is slow and some degradation of pectin is unavoidable.

Table 3 shows that dried citrus peel is reasonably stable when stored at 70° F. (21° C.) but not when stored at 100° F. (38° C.). Pectin quality is significantly impaired, even after storage of peel for one month at 100° F.

SUMMARY

Blanching and washing need have only minor effect of the quality of pectin in citrus peel. Water washing of citrus peels, sufficient to produce a readily filterable extract, can be accomplished with three weights of water per weight of peel in 20 to 30 minutes by the use of a continuous countercurrent washer.

In the drying of citrus peel, the amount of degradation sustained by the pectin therein is dependent upon the temperature of the peel during the drying process. Initial drying temperatures of about 200° F. can be used in drying citrus peel, provided they are of short duration, without seriously affecting the pectin quality. Drying of citrus peel should not be prolonged after the equilibrium moisture content has been attained; otherwise, an unnecessary loss of pectin quality is incurred. Cooling of the peel following drying is essential if the material is to be compacted for storage. The dried citrus peel is reasonably stable upon storage.

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Production of Pasteurized Frozen Egg Products[a]

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Pasteurization of whole egg or yolk at 142° F. (61.1°C.) for two minutes and white at 134° F. (56.7°C.) for two minutes will destroy more than 99 percent of the bacteria including pathogens. It improves the keeping quality of the products and does not injure their functional properties.

The frozen egg industry started about 1900 as a means of salvaging cracked, soiled, poorly shaped and other types of edible shell eggs of low market value. The industry has made a steady growth, accelerated during World War II, until today more than 300,000,000 pounds of frozen egg products are produced annually in the United States (Figure 1). Frozen whole egg

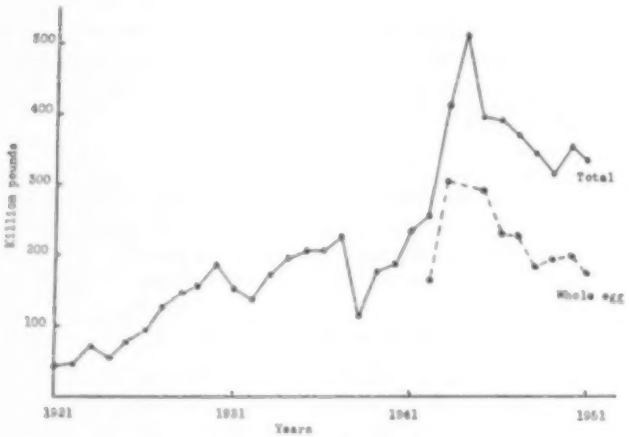

Figure 1. Frozen egg production.

still constitutes more than 50% of the frozen egg products produced but the percentages of frozen white, yolk and specialty products are increasing.

Principal customers for frozen egg products are the bakers and candy, noodle, mayonnaise and salad dressing manufacturers. They prefer frozen to shell eggs because they are cheaper, more uniform, require less space, keep better, save labor and only the part wanted need be purchased.

Some handicaps to greater growth of the frozen egg industry are lack of adequate refrigeration, difficulty in controlling bacterial content, lack of standards for trading purposes, lack of uniformity in color and functional properties, and absence of suitable small frozen packs for restaurant and home use.

The bacterial content of frozen egg products is a serious problem because: (1) bacteria gain entrance from the shells, hands of the breakers and equipment in the breaking process; (2) egg meats, especially yolk and whole egg are good food for growth of bacteria; (3) many of the species of bacteria, found in frozen eggs, multiply even at low temperature, during the freezing and defrosting processes; (4) the bacteria present may alter the flavor and functional properties of the products; (5) pathogenic bacteria may gain entrance to egg products, remain viable for long periods of time; and, result in possible food poisoning outbreaks.

Pasteurization

Pasteurization, as a means of controlling the bacterial content of liquid, frozen and dried egg products has been advocated in recent years. It was generally believed until recently, and the idea is still held by some people, that it is impossible to heat liquid egg products at a high enough temperature or for a long enough time to kill bacteria without causing coagulation of the proteins or otherwise impairing the culinary properties of the egg.

About the time of World War II, the egg drying industry began to flourish in this country. It became common practice to preheat liquid egg before drying in order to reduce viscosity, reduce dryer temperature and increase plant production. One of the operators observed that the preheating process reduced the standard plate and especially the coliform bacterial counts.

Early in World War II complaints were received by the Office of the Quartermaster General and by the United States and Canadian Departments of Agriculture regarding food poisoning outbreaks among the armed forces and civilians in lend lease countries, which were traceable to dried egg products received from the United States and Canada.

The Quartermaster General requested that a study be made of the possibilities of pasteurization (preheating) of liquid egg before drying as a means of destroying *Salmonella* and without injury to the functional properties of the egg.

McFarlane, Watson and Goresline *(6)* observed that liquid egg should be preheated at temperatures higher than 135° F. (51.2° C.), to prevent the multiplication of bacteria. They heated liquid egg in a Votator heat exchanger. The viable bacterial content declined during a 3-second holding period as the temperature was increased from 135 to 150° F. (57.2 to 65.6° C.). At the highest temperature more than 99% of the bacteria were killed.

Winter, Greco, and Stewart *(12)* studied the pasteurization of liquid whole egg in a laboratory pasteurizer and in plate and tubular preheaters. They were able to kill more than 99% of the viable bacteria and all of the coliforms in liquid whole egg without coagulation of the product. Gibbons, et al. *(3)* in Canada, the Egg Producers' Council *(2)* in Australia and more recently Goresline et al. *(4)* of the United States Department of Agriculture have obtained additional data on pasteurization of egg.

Winter, Stewart, McFarlane and Solowey *(13)* and Gibbons et al. *(3)* reported that *Salmonella*, obtained from dried egg products, could be killed when added to liquid egg and pasteurized in an experimental pasteurizer. Schneider *(9)* and Goresline et al. *(4)* have reported similar results with the use of plate heaters in commercial plants. Goresline et al. *(4)* have recently advocated pasteurization of whole egg at 140° F. (60° C.) for 3 minutes for total destruction of *Salmonella*.

Egg yolk and white may also be pasteurized. Wilkin and Winter *(11)* found that white had to be pasteurized at a temperature not to exceed 136° F. (51.8° C.) and preferably not greater than 134° F. (56.7° C.) in order to avoid troublesome film formation on the sides of the pasteurizer. Bacteria were killed more easily in egg white than in yolk or whole egg.

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Pasteurization of egg white at 134° F. (56.7° C.) for 1.6 minutes killed more than 99% of the standard plate count bacteria and all of the coliforms, while 142° F. (61.1° C.) for 2 minutes were required to produce similar results in yolk from the same lot of eggs.

Wrinkle, Weiser, and Winter *(15)* have studied the bacterial flora in a number of samples of whole egg before and after freezing and before and after pasteurization. Freezing reduced the number of bacteria present but had little effect on the number of genera present. Pasteurization reduced the number of genera from 13 to 6. *Alcaligenes, Proteus, Flavobacterium,* and *Bacillus* were the principal genera in both unpasteurized and pasteurized samples.

The question has frequently been raised regarding the effects of pasteurization on the functional properties of egg products. Slosborg et al. *(10)* observed that flash pasteurization of egg white increased its beating time and reduced angel cake volume. Adding sugar to white or lowering its pH as low as 6.5 increased its stability to heat. Some recent studies in our laboratory have shown that the addition of sodium hexametaphosphate (Calgon) produces a similar effect.

Clinger et al. *(1)* reported that egg white pasteurized at 134° F. (56.7° C.) for 4 minutes produced undesirable cakes unless the beating speed and time were practically doubled during the first beating and meringue stage, and then reduced correspondingly during the preparation of the batter. Cakes made from pasteurized frozen white, when the beating procedure was modified, were satisfactory but not quite as good as those made from unpasteurized frozen or fresh egg white.

Pasteurization would be expected to have greater effect on white than on whole egg or yolk because of the sensitivity of white to heat denaturation changes. However, it might interfere with emulsifying and other properties of whole egg or yolk. Hanson, Lowe, and Stewart *(5)* reported less than 5% decrease in sponge cake volume when the whole egg was pasteurized at 140-144° F. (60-62.2°C.) for 1.5-6.5 minutes or 146-148° F. (63.3-64.4° C.) for 0.1-10.5 minutes. The cakes made from pasteurized samples were somewhat less desirable in texture and shape characteristics than those made from control samples. Incorporating 10% flour into the formula corrected the shape and texture but not the volume resulting from the use of pasteurized egg.

Miller and Winter *(7, 8)* reported that pasteurization of liquid whole egg at 140-142° F. (60-61.1° C.) for 4 minutes killed more than 99% of the standard plate and all of the coliform bacteria. Pasteurization before freezing reduced the viscosity of defrosted whole egg. It increased the beating time about 17% over that of the unpasteurized frozen control.

Tests made in cooperation with the School of Home Economics at The Ohio State University have shown that whole egg pasteurized at 144° F. (62.2° C.) for as long as 30 minutes before freezing makes as good custard (Figure 2), sponge cake (Figure 3) and mayonnaise as unpasteurized frozen or shell egg controls.

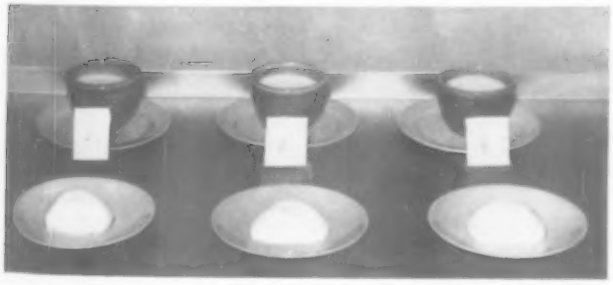

Figure 2. Custard made with (1) pasteurized (144° F. 30 min.) frozen, (2) fresh and (3) unpasteurized frozen whole egg.

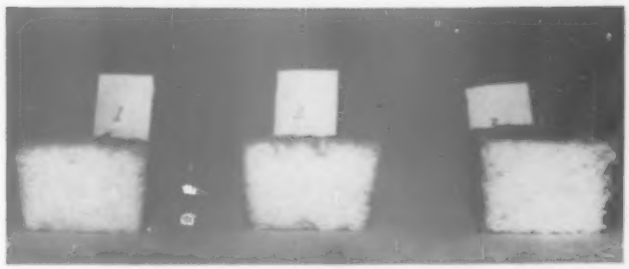

Figure 3. Sponge cakes made with (1) pasteurized (144° F. 30 min.) frozen, (2) fresh and (3) unpasteurized frozen whole egg.

SUMMARY

Pasteurization of whole egg or yolk for four minutes at 140° F. or 142° F. (60-61.1° C.) for two minutes and white at 134° F. (56.7° C.) for the same period of time will destroy more than 99% of the viable bacteria and all of the coliforms and *Salmonella.*

Pasteurization improves the keeping quality of whole egg, white, and yolk, especially when they are held under food refrigerator conditions.

Pasteurization increases the beating time for liquid egg products and results in slightly reduced but not objectionable angel and sponge cake volume. Pasteurization does not impair the value of whole egg for scrambling or for making custards or mayonnaise.

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Food Planning for Infant Feeding[a]

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Twenty-three years ago an infant industry started, an infant industry for the feeding of infants. Unless as fathers or grandfathers you have had recent experience in your immediate families, you may not know how drastic have been the changes in the practices of feeding infants. Although the practices in general use at the present time started about 23 years ago, current methods of feeding with the greatly increased variety of foods in the infant dietary, are less than 23 years old. In fact, ten years or less would cover general acceptance of what is now being done.

When the preparation of commercial baby foods started about 1929, babies were given a milk formula and not much else until they were a year old. At that time a few pediatricians, here and there over the country, started recommending additions of cooked and strained foods, but those used were limited. There was a vegetable soup which was a mixture of cereals, with a few vegetables, mostly carrots and peas. The only fruit was strained prunes. There were three single vegetables, carrots, peas and spinach. For babies who were being fed nothing but milk these five strained foods were a nice variety. However, in 1929, only a few babies were receiving them.

When the commercially canned baby foods were started it was a grave question whether this was the start of a valid new industry, or whether it might be a passing whim. It was learned gradually that babies around ten months of age took these finely strained foods with no difficulty. They appeared to give no digestive troubles, babies liked them, and doctors began to tell each other that they thought their babies on these additional foods did better. It was just about that vague. But, clinical experience gave more and more encouragement though it did take time.

Gradually, over the intervening years the variety of foods has been considerably increased. In the line with which I am most familiar, and most of the manufacturers include approximately the same foods, there are now seven strained single vegetables, six combinations or soups with vegetables and meats, six single strained meats, 8 strained fruits, and three custard puddings, a total of thirty different items. There are no strained artichokes nor onions, although onions are an ingredient in many of the soups. But, most of the common fruits and vegetables which are eaten by the majority of people are eaten by infants in the first year of life.

There are baby cereals. One is of wheat, one of oatmeal, one of barley and another of rice. Each cereal is made from a single grain because of cases of sensitivity of some babies to one or more cereals. These are all enriched with yeast, calcium and iron salts. The grains are finely ground, thoroughly cooked, dried and are ready-to-eat on the addition of milk or milk formula.

Infants may be started on vegetables, or fruits or on cereals as their first more solid food. I know of no reason why they cannot be given strained meats first and I think some babies are.

The foregoing will give some idea of the wide variety of individual foods now purchased or raised by the manufacturer of baby foods. Planning for the manufacture of these finished products involves ingredients not mentioned, for example, salt and sugar, and also tin and glass containers, and shipping cases.

In addition to the strained baby foods, many of the same foods are offered in the line of junior foods; these are not strained but chopped into particles of food. They are fed to older babies between the time when they eat strained foods and ordinary family food. Planning for these foods involves procurement of the same new materials, but the equipment used in manufacturing them is different.

This is all a comparatively new use of and a new market for the products used with new customers of an age group not formerly consuming these particular foods. "New customers" really means just that, for in the past few years babies have been fed these foods earlier and earlier, as they seemed to do better. It was not so long ago that we cautiously mentioned 10 months as a possible starting age, now most babies are started on processed baby food at two or three months. At first only a very small amount of any of these foods is fed, but it isn't long before the baby takes larger and larger portions. As a point of interest, babies now weigh at six months what they used to weigh at one year. The other day a young mother told me her baby ate as many as nine cans of baby food a day! That is not common, but using several cans a day is usual.

At first, the pioneers in this industry used carrots, peas, spinach for vegetables both singly and in soups. Some potatoes were used in soups, and cereals for thickening. Canners were familiar with the vegetables, their procurement and processing. They soon learned some things about the few cereals they used, and that they had to be secured on specification. Then, as the varieties increased in number, they began to go through changes in the purchasing procedures with resulting studies of qualities and their effects. The work of the laboratory in such a plant expanded rapidly and much had to be learned both by laboratory experimentation and factory experience. For example, dried brewers yeast offered new problems. Fresh onions vs. onion powder and dried flakes had to be evaluated for the purpose. Milk and eggs were a new phase of the problems of the laboratory. Fresh and dried milk and dried and frozen eggs were examined and tried experimentally.

In the early days, it was thought by some of the canners who had been in the canning business for a good many years, that the baby food producers might be a market for their crops or even for canned foods which were not of the best quality for adults. It might appear that poorer quality would not be evi-

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dent by the time the vegetable was cooked and then strained. However, just the opposite is true, and now only top quality raw materials are used in baby foods. There were several factors involved in this change of mind. One was, that the manufacturers of baby foods were themselves personally interested and they did not intend that the food for their own babies and those of their friends, should be anything short of top quality. Another factor was that mothers had to be convinced that the quality of the manufactured products was as good as they could prepare. Mothers were not going to take any chances with the food for their babies. If the commercially prepared baby foods were not of equal or better quality than she could prepare herself, she would prepare them. The rest of the family could eat commercially canned foods, but she would be perfectly willing to spend hours cooking and straining little dabs of vegetables and fruits for the baby, if that were necessary to secure the quality she wanted. Another factor was that these foods were fed because of their nutritive value and top quality foods gave better nutritive values. The old "cyclones" used for straining tomato juice and paste were destructive to vitamin C and had to be modified. Condensate had to be conserved instead of discarded because of the soluble vitamins and minerals which could be lost.

For several years there were doctors, and there were a good many of them, who told the mothers of their baby patients to do this preparation themselves. As mothers and doctors became convinced that the manufacturer had access to crops grown under careful supervision and that the time lag between harvesting and the finished food in the can was cut much more than she could do unless she had access to a garden, that the processing by the canner was done with minimum exposure to air and that food in cans was perfectly safe, her confidence in canned foods rose. Uniformity in consistency was another quality the manufacturer could achieve better than she. Babies are particular and want their carrots to have the same thickness and "feel" in the mouth, day after day.

A major job for the manufacturer of baby foods was to build this confidence on the part of the customer. As confidence in baby foods in cans was built up, consumer acceptance of all canned foods rose. Doubtless the amounts of foods purchased on the market for home canning have been influenced, because women became convinced the commercial canner could do a better job than she.

Quality canned foods depend upon superior raw products. The raw products department of a cannery has assumed increasing importance. That is true of canneries producing canned foods for adults. In these days in order to compete with canned foods on the market, a woman has to have the raw vegetables in her own garden and be more or less a specialist in canning.

For instance, the variety of green beans has an influence on both color and flavor. The age of the raw green beans is a vital factor because a large proportion of beans to pod produces a strained food which is brown-green instead of the typical green of green beans. Large, old carrots with a considerable proportion of light-yellow centers do not result in a strained carrot with a rich carrot color. Varieties of peaches differ in colors and flavors, as do apples and other fruits. Thus, procurement of raw products depends not only on availability in sufficient quantities, but also on suitability for the qualities selected as desirable. Product research currently is working intensively on varieties of sweet potatoes suitable for baby foods.

The bacteriologist in the laboratory is concerned with contamination of raw products which are brought into the factory. He is very much concerned with procedures in the factory to insure adequate sterilization. Over-processing to take care of excessive contamination from any source is not permissible because of the effect on quality. The chemist is very much involved in the evaluation of the vitamin content of raw products, depending upon variety, maturity, holding time, etc., with every step in the procedures and equipment used because of the effect on the vitamin content of the finished product. Manufacturers of baby foods give to the Council on Foods of the American Medical Association information on the chemical and vitamin content of their foods, and these figures are published in the Journal of The American Medical Association. The laboratory includes routine daily control testing of products for uniformity of color, texture, consistency and flavor depending upon standards which have been set by management.

New products, of course, bring new problems. Take, for instance, a new product such as custard pudding. A simple custard made of milk, eggs, and sugar would not be satisfactory after adequate processing. Sufficient stabilizer in the form of a starch, or a modified starch, or corn starch or flour had to be used, and adjusted with the eggs to the point where a satisfactory product could be obtained. In the case of the company about which I know, this evolved into an elaborately controlled business for securing satisfactory milk. This system was just nicely worked out when regulations during World War II prohibited the use of fresh milk for such purposes. The milk and sugar were then taken to a condensing plant, and we used the sweetened condensed milk. Thus, the quality of the milk was maintained, but of course, other problems appeared. Dried whole milk and dried and frozen eggs were investigated. These introduced an entirely new set of problems.

Home preparation of custard day after day, for the baby, is a tedious and exasperating job—just a little too much heat and it curdles. Consequently, the custard has been such a good selling item that it has justified all of the work and expense.

The most recent innovation in this simple field of preparing foods for infants, has been a teething biscuit. It is not yet generally available. Formula adjustments were tedious for the biscuit had to be hard enough to give the desired bite resistance for gums with teeth coming through, hard enough not to be messy after a short period of chewing, but not too discouragingly hard, or mothers and babies might decide a scrubbed and boiled stone would serve the purpose. Again, procurement of ingredients was necessary, but with experiences of the cereals to call upon was relatively simple. However, baking of the biscuits was an entirely new matter. As with any new product, the question of consumer acceptance complicates planning. In the case of the biscuits, one problem was the expensive baking equipment and another the machine for individual wrapping of each biscuit. Individual wrapping is expensive. Are mothers going to desire that sanitary feature strongly enough to be willing to pay for it? Will the biscuits sell in sufficient volume to be able to reduce the price to the consumer and still pay for the equipment in a reasonable time?

Such problems have complicated planning in the baby food industry from the beginning. When the first five strained foods were offered in an advertisement in *Good Housekeeping Magazine* for a dollar — including the mailing cost—the planners had no basis for opinions about the possible response. Was the idea a sound one, or was it a fad on the part of a few pediatricians? Were there nutritional, economic, and convenience reasons to justify planning a business? Mothers were not going to use these canned foods unless their doctors approved, so that medical advertising and doctor detail work had to be developed and paid for. The production of foods for babies is now an established industry, but the manufacturers cannot "go off the deep end" by buying equipment and trying to promote products which will not sell.

The production figures for the canned baby food industry, limited to the canned strained and chopped or

junior foods in both cans and glass jars, show its growth. These figures omit the cereals. In 1939, ten years after production started, there were 18,727,000 dozen units produced. Ten years later, in 1949, the production figure was 122,095,000 dozen, over six times as much. The last four years, 1948-1951, indicate something of a leveling off. Production has varied from 119,500,000 dozen to 130,000,000 dozen.

Baby food sales are not only dependent on wise planning, production of quality foods of high nutritive values, advertising and promotion to a new crop of mothers each year, medical advertising and doctor detail work, and selling in markets where competition for shelf space is keen, it is also dependent on a steady supply of new customers each year. In 1939, there were 2,466,000 births in the United States. Ten years later, in 1949, there were 3,650,000 births. The increase in annual births is nowhere near the rate of annual increase in number of cans produced so that the number of births, while important, has not been the determining factor in the growth of the industry. There is no way to correlate from year to year the figures of factory production with number of births, because there are too many imponderable factors involved.

More babies are being fed on canned baby foods and cereals each year. We know they are being fed at an earlier age than even five years ago. The above figures certainly indicate that up to now there has been an ever-increasing number of cans per birth. Perhaps the present feeding practices are producing better babies who grow faster and eat more. Superior nutrition undoubtedly has been one very important factor in the resulting better babies and lowered mortality rates. However, during the second and third year, when the chopped or junior foods are used, the total food intake decreases because the rate of growth slows up.

Where do we go from here on future planning for infant feeding? There may be some increase in the amounts of all or at least of many of the various infant foods now being produced. What new items may be introduced is anyone's guess. It is not just the exercise of imagination; hard commonsense enters in. It would seem from the variety of foods now included on the list of commercially manufactured baby foods that there is not much room for expansion unless the new food items promise sufficient volume of consumption to justify adding them.

A Method for Removal of Peel Oil from Citrus Juices and Process Liquids[a,b]

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(Manuscript received June 12, 1952)

The complete removal of peel oil is essential for the successful methane fermentation of citrus juices. This was accomplished by aeration provided a small amount of either acetone, dioxane or the alcohols, methyl, ethyl or isopropyl was present. Likewise, complete oil removal was possible through the production, in the juice, of alcohol or other organic substances by microbial growth while the juice was being aerated.

During investigations *(4)* on the treatment of citrus wastes it was found that the removal of citrus peel oil from juices or process liquids was necessary for successful fermentation of those materials. This is true to some extent with alcoholic fermentations in which the rapidity or completeness of fermentation is important. It is especially true with methane fermentation which may be used as a means of treating citrus waste waters. A methane fermentation is carried on in a continuous manner and, since any peel oil present attaches itself to particles of bacterial sludge, a gradual accumulation of oil takes place in the fermenting mixture. If peel oil is introduced with the fermenter feed, inhibitory effects may occur when sufficient oil has accumulated.

Most de-oiling procedures in use in the past were not intended to remove all the peel oil. Removal of excessive concentrations of oil is all that is desired when citrus juices are to be canned. Removal is usually accomplished by "flashing" the juice into an evacuated chamber which removes part of the oil and a small percentage of the water. Peel oil may be removed also by evaporating part of the water from citrus liquids *(5, 6, 7)*. However, analysis has shown that a small but definite quantity of peel oil remains in orange juice even after evaporation to 55° Brix. Definite traces of peel oil have been found also in citrus molasses made by the evaporation of liquor pressed from citrus peel. Apparently, evaporation alone does not completely eliminate all of the peel oil in citrus liquids.

In this investigation of the removal of peel oil various procedures were studied. In the initial work citrus juices were subjected to yeast fermentation without aeration. Then aeration under nonaseptic conditions was studied. Finally, aeration under sterile conditions, with and without the addition of ethyl alcohol or other miscible organic solvents, was investigated.

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[b] Cooperative research project of Florida Citrus Commission and Florida Citrus Experiment Station, Lake Alfred, Florida. Florida Agricultural Experiment Station Journal Series, No. 79.

[c] Florida Citrus Commission.

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ANALYTICAL METHODS

To study the complete removal of peel oil it was necessary to consider methods of determining the quantity of oil present. The initial oil concentration could be determined satisfactorily by use of the Clevenger distillation method *(2)*, the accepted method used by the U. S. Department of Agriculture for the determination of the amount of peel oil in citrus juices. However, the Clevenger method was of no value after aeration and fermentation were begun, because of the formation of small amounts of ethyl alcohol by the yeasts present. Since peel oil is soluble in ethyl alcohol, two phases are not formed in its presence and therefore no oil phase results for measurement. Furthermore, Curl *(3)* has pointed out that the Clevenger method is inaccurate for low concentrations of oil.

The method of Burdick and Allen *(1)* gave satisfactory results within the limits of 0.05 and 0.005% oil. In using this method ethyl alcohol was substituted for acetone because of the small amount of alcohol already present in the aerated liquor. Turbidimetric measurements were made with a model 402-E photoelectric Lumetron colorimeter using the blue (420 mμ) filter to obtain maximum sensitivity. A standard curve was drawn with turbidity plotted against the oil content of prepared samples having the following concentrations: 0.005, 0.0075, 0.010, 0.020, 0.030, 0.040 and 0.050% peel oil. Concentrations below 0.005% were measured by extrapolation of the curve. Samples containing more than 0.05% oil were handled by reducing the size of the original sample. The experimental samples were run in a similar manner using this standard curve to obtain the oil concentrations.

In all of the aeration experiments 100 ml. samples were removed for peel oil analysis every hour during the period of aeration unless the removal of oil was slow enough to make this frequency of sampling unnecessary.

PROCEDURES STUDIED AND EVALUATION OF RESULTS

Removal of peel oil by fermentation without aeration was studied first. Three 4 l. Erlenmeyer flasks were sterilized and filled with approximately 3 l. of pasteurized orange juice. After cooling they were inoculated with 10 ml. suspensions of different strains of yeast *(Saccharomyces)*. The original juice contained 0.033% peel oil after pasteurization. After 13 days the average peel oil concentration for all three batches was 0.014% and the liquors contained about 4.4% alcohol by volume. The fermentations were started again by the addition of 500 g. of sugar to each flask and the fermentations were allowed to complete themselves once more. The final average peel oil concentration in all three flasks was 0.005%, with more than 11% alcohol present when this study was concluded after 25 days.

Since these results showed that yeast fermentation with the production of some alcohol was not sufficient for complete de-oiling, the next procedure investigated was plain aeration. In this case indigenous yeasts and bacteria were allowed to develop and in all instances brought about an active fermentation.

The liquid to be aerated was composed of freshly extracted orange juice and, in one instance, grapefruit juice which was adjusted to provide the desired oil content. When the oil content was too low "peel juice" of 0.63% oil content was added to increase the peel oil to the desired level. In other cases in which the oil content was too high, canned tangerine juice containing 0.005% peel oil was used as a diluent. The aeration was carried out in 5 l. stainless steel containers. The volume of the adjusted solution was 4000 ml. at the beginning of the aeration period. The air emanated from holes (0.042" in diameter) drilled in stainless tubing used as spargers. Twenty runs were made under this regimen, including variations in the rate of air flow, temperature and initial peel oil concentration. Temperatures used were 18.5°, 25°, 31°, and 40° C. Aeration rates used were 0.02, 0.05, and 0.10 cu. ft./min./4 l. The initial oil concentrations were approximately 0.02, 0.05, and 0.10%.

Table 1 is a compilation of data obtained from these de-oiling experiments. The completion time, used as a basis for calculating the rate of oil removal, was the total number of hours from the start of aeration until de-oiling was completed.

The average rate of oil removal, ml./cu. ft./hr., is obtained by dividing the initial volume of oil in the juice by the product of the total volume of air passed through the juice and the time required for complete elimination of the peel oil.

There is little discernible correlation between the rate of oil removal and the three variables: peel oil concentration, temperature, and rate of air flow. The reason was not apparent until further experiments, discussed later, had been completed.

As might be expected, large bubbles of air are not as efficient in removing oil as small bubbles. This is shown in runs 21 and 22 in Table 2.

Two runs were made to determine the effect of high pH and treatment with a growth inhibitor. In runs 23 and 24, Table 2, 8 g. of sodium benzoate and 1000 p.p.m. of lime, re-

TABLE 1

Removal of peel oil from orange juice during non-aseptic aeration

Run no.	Rate of air flow cu. ft./min./4 l.	Average temp. °C.	Total vol. air used cu ft.	Time for complete de-oiling hrs.	Total initial oil ml./4 l.	Rate of oil removal ml./cu. ft./hr.
Orange juice with high oil content						
1	0.02	20	32*	27*	1.88	0.0022*
2	0.02	25	32	27	1.88	0.0022
3	0.02	32	—[f]	—[f]	2.08	—[f]
4	0.02	41	—[f]	—[f]	4.01	—[f]
5	0.05	19	92*	31*	3.14	0.0008*
6	0.05	28	48*	16*	2.00	0.0026*
7	0.05	31	57	19	2.18	0.0020
8	0.05	38	29	10	2.00	0.0070
9	0.10	19	72	12	2.05	0.0024
9a	0.10	19	82*	14*	2.08	0.0018*
10	0.10	25	60	10	2.04	0.0034
11	0.10	31	54	9	2.04	0.0042
12	0.10	38	48	8	4.01	0.0105
Orange juice with low oil content						
13	0.05	20	18	6	0.78	0.0072
14	0.05	25	24	8	0.70	0.0037
15	0.05	31	21	7	0.74	0.0050
16	0.05	41	21	7	1.22	0.0083
17	0.075	20	23	5	0.78	0.0069
17a	0.10	19	36	6	0.82	0.0038
18	0.10	25	36	6	0.70	0.0033
19	0.10	30	42	7	0.74	0.0025
20	0.10	41	42	7	1.22	0.0042

[a] Repeat of previous run. * Estimated. Unfinished run. [f] Unfinished run. Too incomplete to estimate.

TABLE 2

Effect of air bubble size, addition of sodium benzoate and addition of lime on rate of removal of peel oil from citrus liquids by aeration

Run no.	Description	Rate of air flow cu. ft./min./4 l.	Average temp. °C.	Total vol. air used cu ft.	Time for complete de-oiling hrs.	Total initial oil ml./4 l.	Rate of oil removal ml./cu. ft./hr.
21	Air introduced through glass tube 0.200" diameter	0.05	32	54	18	1.72	0.0017
22	Air introduced through Gooch crucible with coarse fritted disc	0.05	32	41	14	1.72	0.0032
23	Sodium benzoate (8 g.) added to juice	0.05	21	53	18	0.86	0.0009
24	Lime (1000 p.p.m.) added to juice	0.05	21	45	15	0.97	0.0014

spectively, were added to the initial juice. The rates of oil removal in both runs were definitely lower than when no chemicals were added. This observation gave a clue to the reason for the variable rates of oil removal in the previous 20 runs (Table 1). No attempt was made in these runs to control the growth of microorganisms, and it was noticed that their growth was not uniform. When growth was definitely held in check by the addition of lime or sodium benzoate, the oil removel was slow. This implied that the growth of microorganisms assisted in the removal of oil. The mechanism involved might be associated with the formation of alcohol in the liquid.

To test this hypothesis two 16-liter quantities of freshly extracted juices were pasteurized and, to prevent later contamination, to each was added 20 p.p.m. of mercuric chloride. To one was also added 800 ml. of 95% ethanol, making the concentration 4.52% by volume. The other was used as a control without alcohol. Air, filtered through cotton, was blown through each batch of juice at the rate of 0.10 cu. ft./min./16 l.

Figure 1 shows a plot of the results obtained. Peel oil concentrations in each batch of juice decreased from an initial 0.035% oil in almost equal amounts for the first 14 hours. At this time the orange juice containing alcohol had 0.003% peel oil and the alcohol-free juice contained 0.0035% oil. In the next 2 hours the juice containing alcohol became completely oil-free, while the juice without alcohol still contained 0.003% peel oil after 28 hours when the experiment was terminated.

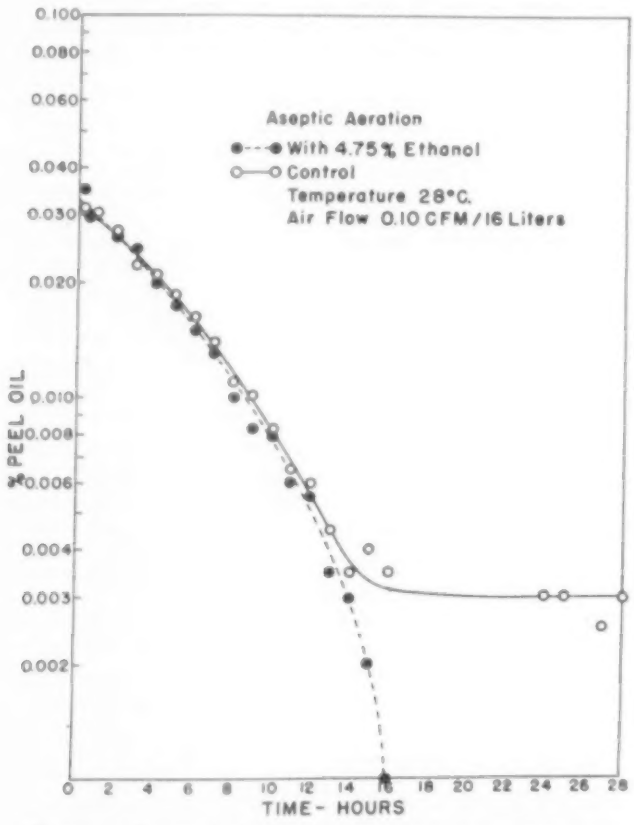

Figure 1. Removal of peel oil from orange juice, under aseptic conditions, by aeration with and without the addition of ethyl alcohol.

To determine whether other alcohols and miscible organic solvents would accomplish the same result, 5 tanks were set up each containing 16 liters of orange juice of 0.04% peel oil content prepared as above. One batch was kept as a control, while to the other 4 batches 800 ml. of one of the following were added: methyl alcohol, isopropyl alcohol, dioxane, and acetone. Air, filtered through cotton, was blown through each tank of juice at the same rate as in the previous experiment. The rate of oil removal of all 5 batches was similar for the first 6 hours, after which the control started to fall behind. The batches containing dioxane and acetone showed no detectable peel oil after 11 hours of aeration. The batches containing methyl alcohol and isopropyl alcohol showed no detectable peel oil after 14 hours. Even after 24 hours of aeration the control batch still contained a definite trace of peel oil, which was estimated to be between 0.002% and 0.003%. The effects of the 4 solvents in promoting the elimination of peel oil, therefore, were apparently the same as the effect of ethyl alcohol.

DISCUSSION

Evaporation alone does not remove all the peel oil, since both orange juice concentrated to 55° Brix and citrus molasses at 72° Brix still contain a trace of peel oil. The latter material, made by the evaporation of citrus press liquor, is concentrated from 10 to 12% solids to 72% solids. One would expect that all of the essential oil would be removed by this operation. Indeed, an analysis by the officially recognized Clevenger method did indicate no oil present. Only with the use of the sensitive Burdick and Allen procedure for determining peel oil was oil detected in citrus molasses. Similarly, yeast fermentation alone will remove a portion but not all of the peel oil from citrus juices.

When citrus juices are aerated peel oil is removed, but the speed and completeness of the removal varies considerably with conditions. In general, more rapid de-oiling results when higher temperatures, more air and smaller air bubbles are used. If microorganisms, particularly yeasts, are allowed to grow during aeration the effects of the other factors may be obscured. Results reported here indicate that microbes exert their influence through the production of alcohol in the liquid.

An unexpected observation appeared when sterile juice was aerated. There is a small but definite fraction of the oil that is non-volatile. If, however, a sufficient quantity of methyl or ethyl alcohol, dioxane or acetone

is present, even this small remainder of oil can be removed by aeration. The reason for this phenomenon can only be surmized at present.

SUMMARY

A small portion of citrus peel oil is ordinarily nonvolatile. This portion remains in citrus liquids even after a major quantity of water has been evaporated or after extended aeration of the product. Complete removal of oil from juices can be accomplished by aeration in the presence of acetone, dioxane or the lower aliphatic alcohols. Alcohol may be produced *in situ* by microbial growth during aeration, thereby making possible complete oil removal.

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Effect of Subtilin on Spoilage of Thermal Processed Beef[a,b,c]

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(Manuscript received May 10, 1952)

An investigation was made of comminuted beef inoculated with 4 levels of spores of P. A. 3679, 4 levels of subtilin, and heat processed at 3 temperatures and 3 times according to a factorial design. The use of a multiple linear regression is suggested to determine the percent of spoilage expected for any combination of spore concentration, processing temperature, processing time and subtilin concentration with the ranges used experimentally. The rate and extent of spoilage of samples indicate that subtilin is sporostatic. High levels of subtilin with mild thermal processes do not permanently inhibit the germination of the putrefactive anaerobic spores in beef. A combination of a high level of subtilin with heat processing apparently is necessary for extended inhibition of heat resistant spores in beef.

The use of an antibiotic in conjunction with heat for the processing of canned foods has undergone considerable investigation since the time of its proposal in 1950 by Andersen and Michener *(2)*. Morse *(8)* discussed many of the advantages and disadvantages of this procedure for food preservation.

The reports of Bohrer *(3)*, Burroughs and Wheaton *(4)*, Cameron *(5)*, and Williams *(11)* have contributed much of the information that is necessary to evaluate the effect of antibiotics and mild heat in processing canned foods. Olcott *(9)* cited some of the pertinent bacteriological problems involved in the application of antibiotics to food processing. Recently, Cameron and Bohrer *(7)* enumerated the elements of proof required before preservation of foods with antibiotics may be justified.

In a preliminary report Adams, Ayres and Tischer *(1)*, mentioned some of the effects of subtilin on spores of a heat resistant, putrefactive anaerobe in beef. Several aspects of this study, now completed, are of especial interest at this time due to the increased production of canned meat products to fulfill the needs of the armed forces in overseas areas. The general practice in the meat industries to assure a wholesome meat product in large tins is to use a relatively mild heat process and subsequent refrigeration of the processed meat. Such heat processes reduce the bacterial load leaving only the more heat resistant spores of putrefactive bacteria viable. The refrigeration of the processed product is necessary to prevent germination of surviving spores.

It would be desirable from the standpoint of economics alone to process meat in large tins by the application of mild heat, obviating the subsequent need for refrigeration to assure preservation of the product. This objective could be attained if spoilage bacteria and their spores were destroyed or permanently inhibited by some agent other than heat. The influence of antibiotics on bacterial spores in meat products was considered a means by which a mild heat process might be effected without need of subsequent refrigeration.

This paper describes an investigation designed to determine the extent of the adjuvant action of the antibiotic subtilin and heat in preserving samples of comminuted beef which were inoculated with heat resistant spores of a putrefactive anaerobe.

EXPERIMENTAL METHODS

Comminuted beef was inoculated with each of 4 levels of subtilin (0, 10, 100 and 1,000 p.p.m.), 4 levels of spores (0, 100, 10,000 and 1,000,000 per g.), and processed at temperatures of 180°, 212° and 240° F. (82.2°, 100° and 115.6° C.), respectively, with processing times of 1, 5 and 10 minutes in a simple factorial design. Each determination was repeated 4 times using 4 tubes for each determination.

[a] Journal Paper No. J 2107 of the Iowa Agricultural Experiment Station, Ames, Iowa. Project Nos. 1017 and 1123.

[b] This paper reports research undertaken in cooperation with the Quartermaster Food and Container Institute for the Armed Forces, and has been assigned Number 389 in the series of papers approved for publication. The views or conclusions contained in this report are those of the authors. They are not to be construed as necessarily reflecting the views or indorsement of the Department of Defense.

[c] The physiological effects of subtilin and other antibiotics, if used in foods, have not been clearly established. Practical use of these agents in foods is not permitted at the present time.

Fresh frozen samples of canner's grade beef were obtained from a commercial meat packing plant and partially thawed in 18-24 hours at a temperature of 40° F. (4.4° C.). Using aseptic technique, excessive connective and fatty tissues were trimmed under the protective covering of a laboratory hood. The trimmed beef was comminuted for 20 minutes in a Hobart Silent Food Cutter.

Comminuted beef allowed optimum conditions for thorough distribution of the antibiotic and spores, minimized sampling variation, and provided equivalent thermal characteristics among different samples.

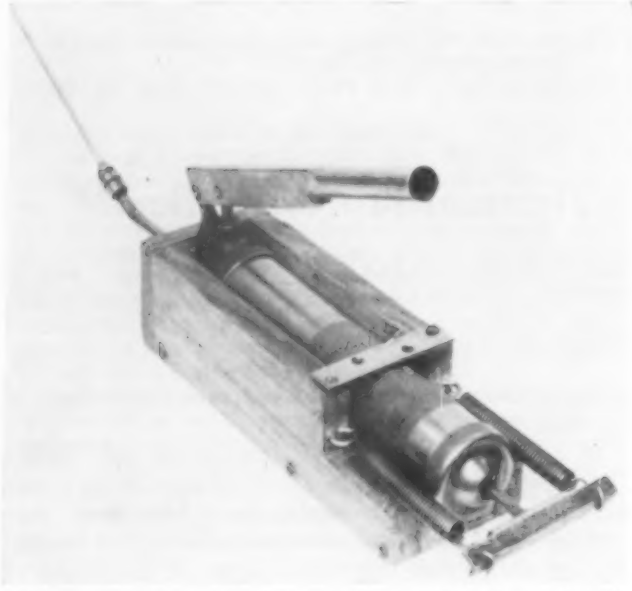

Figure 1. Gun employed to transfer samples of comminuted beef into small glass tubes.

Comminuted samples of beef were inoculated with spores of a species of *Clostridium*, commonly referred to as P.A. 3679. A stock suspension of 125,000,000 spores per milliliter was prepared in accordance with the methods described by Stumbo, Murphy and Cochran *(10)*. Use of this concentrated suspension allowed inoculation of spores without greatly changing the content of moisture in the sample of meat.

Subtilin was dissolved in acidified, distilled water so that diluted aliquots represented 100% potency. Precautions were taken to assure minimum exposure of the stock solutions to light and to storage temperatures higher than 40° F. (4.4° C.). Initially the potency of the subtilin used was 19,000 units per milligram. After 8 months of storage, assay indicated a 10% decrease in potency.[4]

Appropriate quantities of spores and subtilin were mixed aseptically into samples of comminuted beef by means of a KitchenAid Model K4-B Mixer. The spore-subtilin-beef mixture was packed into the sterile barrel of a spring-primed grease gun (Figure 1). Sufficient compression to expel the sample was made possible by attachment of 2 springs.

The comminuted mixture was forced through the metal nozzle of the gun into 9 x 100 mm. Pyrex tubes. Tubes were sealed above the level of the meat in a blast burner flame at 100 mm. reduced pressure. This tube technique, similar to that used in thermal death time studies, was used to reduce thermal lag during processing.

Tubes of meat processed at the 180° F. (82.2° C.) temperature were preheated at 122° F. (50° C.) for 5 minutes, and those processed at 212° F. (100° C.) and 240° F. (115.6° C.) were preheated at 176° F. (80° C.) for 5 minutes in thermoregulated water baths. Preheated samples were allowed a 2-minute come-up time and then were heat processed in thermoregulated oil baths. At time intervals of 1, 5 and 10 minutes, tubes were removed from the processing baths, immediately cooled in ice water, and incubated at 98.6° F. (37° C.).

Spoilage of beef during incubation was determined by changes in appearance, color, odor and texture. The most useful criterion of spoilage was change of color. Generally, an initial reddish discoloration preceded darkening of the meat. Tubes of beef were considered spoiled when the degree of darkening exceeded that of control tubes. Microscopic examination and subculture of representative tubed samples of meat, which were considered spoiled, established the reliability of this criterion.

Samples of beef which were inoculated with spores, treated with antibiotic, processed with heat, and still appeared sound after 100 days of incubation were subcultured in Bacto Linden fluid thioglycollate medium containing 0.1% soluble starch. Recovery of P.A. 3679 was substantiated by digestion of meat, production of gas, presence of putrefactive odor, and morphology of stained cells.

RESULTS AND DISCUSSION

With one exception, samples of beef containing no subtilin (0 level) showed evidence of spoilage with 6 days of incubation. Only 28% spoilage occurred after 100 days of incubation in meat which was inoculated with a load of 100 spores per gram and given a heat treatment of 240° F. (115.6° C.) for 10 minutes.

In samples of beef which differed only in the amount of subtilin incorporated it was assumed that the differences in spoilage rate resulted from the effects of the antibiotic.

The average effect of each of the four variables: temperature, time, spores and subtilin, was plotted as an individual trend (see Figure 2). If it is assumed that

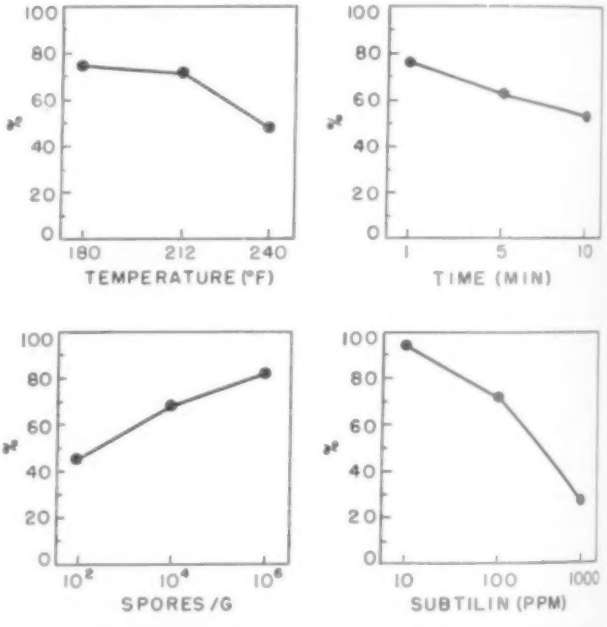

Figure 2. Average effect of temperature, time, spores or subtilin on percent of spoilage of comminuted samples of beef.

the levels of temperature, time and spore load represent reasonable ranges which might be used in processing, it may be observed that an increase from 10 to 100 p.p.m. of subtilin reduces spoilage by approximately 20%. Only when the level of subtilin is raised to 1000 p.p.m. is the effect great enough to assume importance in

[4] The authors are indebted to Merck & Company, Rahway, N. J., for supplying and assaying the subtilin used, and to the Western Regional Research Laboratory, Albany, Calif., for assaying the subtilin for potency.

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preservation, and addition of the antibiotic at that level would probably be costly and impractical.

The activity of subtilin on the germination of spores of P.A. 3679 in a beef substrate may be observed from Figure 3. With increasing levels of subtilin a longer incubation time is indicated before the initiation of spoilage. Apparently this indicates that subtilin activity is involved in inhibition of spore germination; as the concentration of subtilin increases, there is a corresponding increase in time elapsing before spore germination.* Cameron *(6)* mentioned that the mechanism of subtilin action involves inhibition of germination of spores and, in some cases, this effect may be permanent.

The extent of spoilage of beef samples after 100 days of incubation is indicated in Figure 4. Levels of antibiotic as high as 1,000 p.p.m. in conjunction with the mild heat treatments of 180° F. (82.2° C.) and 212° F. (100° C.) for 1, 5 and 10 minutes did not exert sufficient sporostatic effect in beef to prevent spoilage by 100 or more spores of a putrefactive anaerobe per gram. Olcott *(9)* mentioned that the larger the inoculum the greater the amount of subtilin required to prevent spoilage. This observation is readily verified in Figure 4.

Although the 2 heat processes at 180° F. (82.2° C.) and 212° F. (100° C.) have only a small effect on spoilage (see Figure 4) with the processing temperature of 240° F. (115.6° C.) there are 3 combinations of the variables showing little or no spoilage of samples after 100 days of incubation. In all of these cases the time of processing was 10 minutes. With this thermal process preservation for 100 days at 37° C. occurred with samples of beef that contained a spore load of 100 per gram and 100 p.p.m. of subtilin, or a spore load of 10,000 per gram and 1,000 p.p.m. of subtilin. The dependability of the sporostatic effect of subtilin on these spores in a beef substrate, however, is probably not a reliable occurrence even with such a relatively high thermal process. To exemplify this, it may be observed that there was no spoilage with samples containing 1,000 p.p.m. of subtilin and a spore load of 10,000 per gram, but 6% spoilage occurred with samples containing this same level of antibiotic and only 100 spores per gram. Such variation is unpredictable and may be due, in part, to beef lipids surrounding certain spores or cells and protecting them from the activity of the antibiotic. There is also the possibility that once putrefaction is initiated in a meat substrate the pH may be altered to such an extent that the activity of the antibiotic is greatly retarded or neutralized. Factors that interfere with the action of subtilin may be great in number and may vary considerably among different foods. The determination of the nature of such interfering factors and the means by which they can be eliminated without changing the identity of the food substrate are topics which must be investigated before an antibiotic can be used with assurance in the field of food processing.

Ten of 163 subcultured samples yielded viable P.A. 3679 organisms. These samples were distributed among different combinations of the variables with 7 of the 10 having in common a level of 1,000 p.p.m. of subtilin. Here again is good indication of the sporostatic effect of subtilin. Even though germination of spores was inhibited during incubation of these samples for 100 days, germination occurred soon after samples were diluted $\frac{1}{25}$ in the subculture medium of pH 7.2. According to the work of the Western Regional Research Laboratory *(12)*, this pH reduces the activity of subtilin to 32% after 6 days at 37° C. and decreases the solubility of subtilin to less than 0.5%. Also, Bohrer *(3)* mentions that potency of subtilin decreases during storage of foods containing the antibiotic. These factors indicate that subtilin concentrations were reduced in the subculture medium to levels which were noninhibitory to germination of spores. There is the possibility, then, that the spores of P.A. 3679 which survived the thermal process of 240 °F. (115.6° C.) for 10 minutes and failed to germinate in the subculture medium were destroyed by the activity of the initial high level of subtilin in the beef substrate.

The consideration of the effects of spore load, time and temperature of processing and amount of subtilin, up to this point, has not taken account of the combined

* Since the preparation of this manuscript Andersen suggests [*J. Bact.*, 64, 145 (1952)] that subtilin is not effective against many of the spores until the germination process is started.

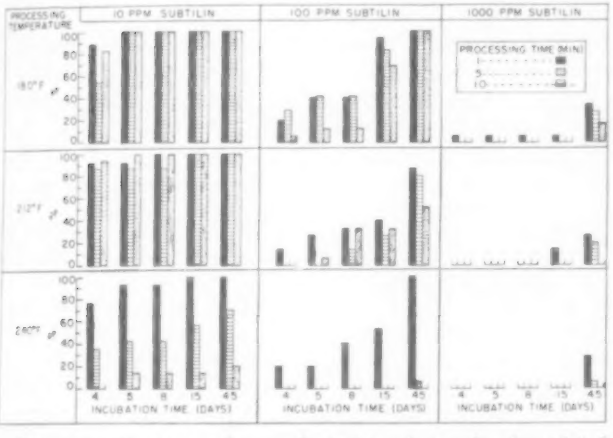

Figure 3. Spoilage of comminuted beef samples inoculated with 100 spores of P. A. 3679 and treated with one of three levels of subtilin, processing temperature and processing time.

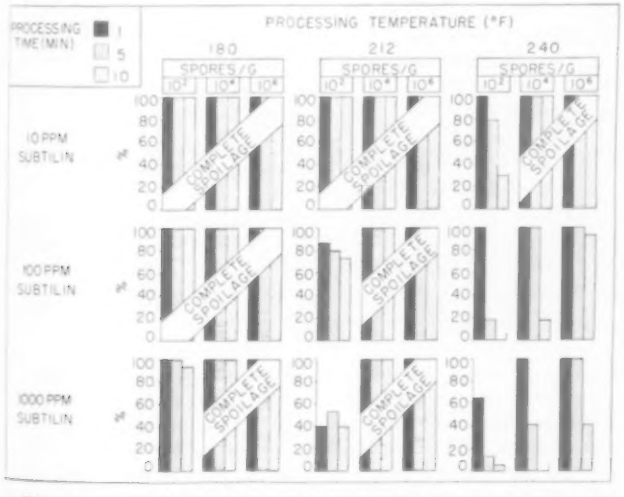

Figure 4. Spoilage after 100 days of beef samples treated with each of three levels of antibiotic and spore concentrations, and processing temperature and time.

effects of all the treatments on the amount of spoilage observed.

One simple method useful for overcoming this difficulty is to combine the results into a multiple regression. Ideally, this would include the four main variables, the incubation time and the amount of spoilage as elements in the regression.

The spoilage data at 15 days reflect the general pattern of effects for the four main variables. In the interests of simplicity these data are presented as an example of the use of multiple regression for all the variables except incubation time.

Calculation of the regression results in an expression:

$$\hat{Y} = 157.1658 + 9.1944X_1 - 0.450012X_2 - 2.3497X_3 - 0.059771X_4$$

in which;

$\hat{Y}$ = estimated percent of spoilage for the conditions imposed.
X_1 = log of the spore concentration.
X_2 = processing temperature (° F.).
X_3 = processing time (min.).
X_4 = subtilin concentration (p.p.m.).

As would be expected, increase in spore concentration increases the amount of spoilage while, increase in processing time, temperature and concentration of subtilin decreases the amount of spoilage.

The correlation values associated with the regression are †

$$r_{X_1Y} = 0.3675^{**}$$
$$r_{X_2Y} = -0.2700^{*}$$
$$r_{X_3Y} = -0.2117$$
$$r_{X_4Y} = -0.6539^{**}$$

which indicate that the most significant effects are due to spore concentration and subtilin concentration.

An example of the use of this expression for prediction of the amount of spoilage may be useful. If,

$X_1 = 2$
$X_2 = 240$
$X_3 = 1$
$X_4 = 100$

the equation becomes:

$$\hat{Y} = 157.1658 + (2)(9.1944) - (240)(0.450012) - (1)(2.34973) - (100)(0.059771).$$

Hence, $\hat{Y} = 59\%$, the amount of spoilage to be expected under these conditions. Comparison with Figure 3 indicates close agreement with the data.

Extrapolation is not to be recommended. As an example in support of this contention, consider what the estimate of percent spoilage would be if X_1, X_2, X_3 and X_4 were all held at zero. The estimated percent spoilage would then be 157.1658 and such a value is clearly untenable. This emphasizes the need for restricting the use of the multiple regression equation to the ranges of the factors used experimentally.

† * Significant at P = .05.
** Significant at P = .01.

SUMMARY AND CONCLUSIONS

Comminuted beef inoculated with known spore loads of a putrefactive anaerobe was used to test the effect of the antibiotic subtilin in combination with heat in preserving meat sealed in thermal death time tubes. Effects of different levels of subtilin, spores, processing temperature, and processing time were investigated according to a $4^2 \times 3^2$ factorial design. The effects of these four variables indicate that subtilin caused the greatest decrease in spoilage, and increase in spore load caused the greatest increase in spoilage of comminuted beef. Rates of spoilage of meat indicate that the activity of subtilin is involved in inhibition of spore germination and that the extent of spoilage is related to the concentration of spores and antibiotic. When the level of spores in beef is 10,000 or greater, subtilin at a level of 100 p.p.m. exerted a negligible effect on rate and extent of spoilage of samples. Mild heat processes of 180° F. (82.2° C.) and 212° F. (100° C.), even in the presence of 1,000 p.p.m. of subtilin, are relatively ineffective in preserving comminuted beef. A combination of a high level of subtilin and a relatively drastic thermal process apparently is prerequisite for the extended inhibition of heat resistant spores in beef. Addition of the antibiotic to beef at the level necessary for preservation might prove costly and impractical. A multiple linear regression is presented relating the four main variables to the percent of spoilage after 15 days.

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Certain Partial Ester Emulsifier Levels in Food[a]

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(Manuscript received July 18, 1952)

Food emulsifier use levels for certain sorbitan partial esters of fatty acids, polyoxyethylene derivatives thereof, and polyoxyethylene derivatives of fatty acids, have been studied with respect to bakery products, ice cream, confections, soft drinks, dill pickles and other food products to which they are technologically applicable. The average use level of these emulsifiers in such food products is about 0.2%, with no single food averaging more than 0.7%. The aggregate amount of these emulsifiers likely to be ingested from all of such foods in the normal average diet is about ½ gram per person per day or about 0.024% of the "as is" diet (0.08%, dry basis), with a maximum practical limit of about ¾ gram per person per day or about 0.038% of the "as is" diet (0.125%, dry basis).

This paper deals chiefly with the levels or amounts used of members of 3 classes of partial ester, non-ionic emulsifiers, which are added to certain foods in very small amounts to satisfy special needs *(33)*. They include certain sorbitan partial esters of fatty acids, certain polyoxyethylene derivatives thereof and certain polyoxyethylene derivatives of fatty acids which have been technologically selected for several food uses, based on their specific efficiencies and their physical characteristics *(57)*, together with an extensive knowledge of their suitability for human ingestion *(2-4, 6, 7, 11-14, 23, 26-31, 34-36, 38-46, 50, 52-55, 60-63, 66, 67, 70, 76, 77)*.

THE NATURE OF THE FOOD EMULSIFIERS

Food technologists have established the fact that a variety of emulsifiers are required for optimum results in different foodstuffs. This is provided by balancing the emulsifiers differently, with respect to their fat and water affinities *(57)*. Because of their affinity for both fat and water, emulsifiers enable fats and oils to mix more readily with water to form emulsions *(22, 59)*. An essential characteristic of the emulsifiers is "surface activity" or their ability to reduce surface tension and the interfacial tension between fats and oils and/or gases and water. Emulsifiers occur naturally in our most common foodstuffs, such as milk and eggs *(32, 56, 64)*, and they are found in the natural digestive fluids of the body *(19)*.

Practically all of the emulsifiers produced synthetically for food use are non-ionic compounds[b] known as "partial esters" *(22)*. They are made by combining long-chain fatty acids derived from farm-produced fats and oils, such as stearic, palmitic or oleic, with one of the higher alcohols, such as glycerol or sorbitol. Partial esters differ from fats in that not all of the possible hydroxyl groups of the polyhydric alcohol are esterified by fatty acid radicals *(56, 64)*. Chemically-produced partial ester emulsifiers can be classified in 4 general groups as follows:

Group 1. Partial glyceride esters, including monoglycerides and di-glycerides, made by reacting either fatty acids or triglycerides with glycerol.

Group 2. Partial esters made by reacting either fatty acids or triglycerides with sorbitol.

Group 3. Polyoxyethylene (p.o.e.) derivatives of the sorbitan partial esters.

Group 4. Polyoxyethylene (p.o.e.) derivatives of the fatty acids.

It will be apparent that the nature of the non-ionic food emulsifiers, discussed herein, is quite distinguishable from the hydrophilic gums *(69)*, some of which are also used in foods, and from the ionic types of emulsifiers (cationic and anionic) *(22, 59)* which are considered generally unsuitable for use in foodstuffs, with one or two exceptions.[c]

Specifically, the particular food emulsifiers under discussion in this paper are from Groups 2, 3 and 4. There are 11 of them, of current importance, as listed in Table 1. In each group, they are shown in ascending order with respect to their hydrophile-lipophile balances (HLB values) *(21)*. Also shown are their physical forms and their general water dispersibility or "solubility" characteristics.

TABLE 1
Characteristics and HLB values of food emulsifiers of current interest

Emulsifier	Form @ 25° C.	HLB
Group 2 emulsifiers		
Sorbitan monostearate	Waxy solid	4.7 (wd)[d]
Sorbitan monopalmitate	Waxy solid	6.7 (wd)
Glycerol sorbitan laurate	Oily liquid	7.6 (wd)
Group 3 emulsifiers		
p. o. e. (4)[e] sorbitan monostearate	Waxy solid	9.6 (wd)
p. o. e. (20) sorbitan tristearate	Waxy solid	10.5 (wd)
p. o. e. (20) sorbitan monostearate	Oily liquid	14.9 (ws)[f]
p. o. e. (20) sorbitan monooleate	Oily liquid	15.0 (ws)
p. o. e. (20) sorbitan monopalmitate	Oily liquid	15.6 (ws)
p. o. e. (20) sorbitan monolaurate	Oily liquid	16.7 (ws)
Group 4 emulsifiers		
p. o. e. (8) monostearate	Waxy semi-solid	11.1 (wd)
p. o. e. (40) monostearate	Waxy solid	16.9 (ws)

[d] WD—water dispersible.
[e] The figures in parentheses show the number of oxyethylene units per mol.
[f] WS—water "soluble."

[a] Presented at the Twelfth Annual Meeting of the IFT, Grand Rapids, Michigan, June 11, 1952.

[b] Lecithin is another type of food emulsifier, which is essentially non-ionic with both fat-affinity, due to its fatty acid radicals, and water-affinity, due to its choline-phosphate-hydroxyl groups. It occurs as protein complexes in milk and eggs, and for commercial use is largely recovered from soybeans by a chemical process *(32)*.

[c] Monostearine sodium sulfo-acetate, an anionic emulsifier, is listed as an optional ingredient in the U. S. F. S. A. standard for margarine *(74)*.

TECHNOLOGICAL VALUES

Nutritionists have long recognized the great value of such food adjuncts as flavors, condiments and sauces, out of proportion to their nutrient content, because they increase the acceptability of foods, with obvious beneficial effects in nutrition *(24)*. Many food technologists believe that the food emulsifiers under discussion should also be classified as nutritionally valuable adjuncts, on account of their ability to make certain nutritious foods more attractive. In fact, certain new food products have been developed and improvements have been imparted to others, which previously had not been found possible. Four categories of technological advancement in foods are shown, as follows, and under each of these categories are listed examples of foods in which the emulsifiers have proved effective:

1. **Improved texture and eating quality.** Yeast-raised breads, rolls, buns and doughnuts, cakes—including those made from prepared mixes, ice cream, caramels.

2. **Prolonged palatability and other keeping qualities.** Yeast-raised breads, rolls, buns and doughnuts, coated candy bars.

3. **Improved flavor and/or vitamin oil dispersion.** Soft drinks, dill pickles, hard candies, vitamin drops, fresh, whole milk (non-homogenized).

4. **Improved appearance and uniformity.** Cakes—including those made from prepared dry mixes, ice cream, cream whip, compressed yeast, sugar (syrup) coated chocolate ovals.

The technological functions of the emulsifiers will be briefly discussed along with the amounts of the emulsifiers required.

Amounts (Percent) of the Emulsifiers Used

(a) *Cereal Bakery Products.* The first group of cereal bakery products, shown in Table 2, are the yeast-raised products, namely, breads, rolls, sweet buns and doughnuts. The emulsifier chosen and marketed for use in all of this group of products is *polyoxyethylene (8) monostearate*. In breads and rolls the effective amount ranges between ¼% and ½% on the flour or from

TABLE 2
Level of emulsifier use

Yeast raised cereal food product	Emulsifier	Av. tech. desirable, customary level	Maximum practical level
Breads and rolls	p.o.e. (8) monostearate	0.25%	0.34% [c]
Sweet rolls and doughnuts		0.34%	1.00%

[c] Max. level proposed for Federal Breads and Rolls Standards.

0.17% to 0.34%, with the customary level at 0.25% in the finished products. For sweet goods, the usual amount required is 0.34% with a maximum practical level of 1% in the finished product. This corresponds to a range of ⅔% to 2% on the flour contents of these items.

The main purpose of using this and other emulsifiers in this type of product, as previously reported by other investigators *(9, 16, 18)*, is to retard the rate of progressive hardening after baking, so as to retain a high level of palatability for at least a day or so longer. This improvement is important to the consumer, as reflected by the popularity of the products containing emulsifiers and as substantiated by consumer surveys *(5)*. The mono- and diglyceride emulsifiers have been shown to produce similar effects in these products *(16)*.

It is rather well established that straight fat, such as lard, has a minor effect in retarding the rate of hardening of bread crumb, with but little additional improvement for levels of fat beyond about 1% *(16)*. Certain emulsifiers, however, are shown to have a much more profound hardness-retarding effect and this effect is progressively more pronounced with increased amounts in the bread. This was found to be true for both the partial glyceride and the polyoxyethylene stearate types of emulsifiers. In the case of the polyoxyethylene stearate type, however, a given degree of effect is accomplished with about half the amount required.

The new bread standards reject the softness-prolonging effect of emulsifiers in bread as being deceptive with regard to freshness *(75)*. On the other hand, these new bread standards tentatively permit the baker to use certain mono- and di-glyceride emulsifiers to produce this effect, providing he uses, at the same time, a proportionate amount of fat in the bread.[b]

Table 3 shows cakes. The technological advantages of the partial glyceride emulsifiers in the shortenings used for cakes

TABLE 3
Level of emulsifier use

Cakes	Emulsifier	Av. tech. desirable, customary level	Maximum practical level
With shortening (incl. bakery and prepared mix types)	80/20 blend of sorbitan monostearate or palmitate and p.o.e. (20) sorbitan monostearate or palmitate	0.27%	0.32%
Sponge type (no shortening)	blends of p.o.e. sorbitan monostearates	0.70%	0.81%

have been recognized for about 20 years *(8, 25, 33)*. More recently, however, these and other suitable emulsifiers have become available to bakers, separate from the shortening *(37)*.

For use in all types of cakes, made with shortening, certain of the sorbitan type emulsifiers have proved most efficient *(37, 51)*, (i.e. smaller amounts are required to impart a given effect). In particular, combinations of sorbitan monostearate or palmitate or oleate with polyoxyethylene *(20)* sorbitan monostearate or palmitate, have been selected and special blends are marketed for this purpose. The effective range of these emulsifiers for cakes is 0.2% to 0.32% of the finished product, with a general average of about 0.27%.

Sponge cake, which contains no shortening, requires a slightly different hydrophile-lipophile balance in the emulsifiers for best results. In this case, the amount of emulsifier ranges from 0.4% to 0.81% of the finished cake, with a customary level of about 0.7%. Although the most popular choice for sponge cakes is a special blend of polyoxyethylene sorbitan monostearates, blends of these with sorbitan monostearate often produce very satisfactory results.

In all of these products, the emulsifiers produce finer and more uniform texture with improved lightness, tenderness and eating qualities. They facilitate simplified one-stage mixing procedures with unusually high degrees of reliability and uniformity. This feature makes possible the successful marketing of prepared cake mixes *(71)*, both to the baker and to the cake-baking novice in the home.

(b) *Ice Cream.* Ice cream data are shown in Table 4. Testimony is currently being presented at the F.D.A. Ice Cream standards hearings in behalf of 5 of the 11 emulsifiers under discussion. These 5 are alternates for use either individually or in combination, at customary levels ranging from 0.04% to 0.12%. An overall maximum of 0.2% is being proposed at this hearing, to allow for the less efficient types of emulsifiers.

The main technological purpose for using these emulsifiers in ice cream, ice milk and related frozen confections is to promote a finer dispersion of fat particles and air cells. This has already been extensively discussed in the literature *(49, 56-58, 64, 68)*. An outstanding practical advantage is that the frozen product is made more dry and stiff as it is drawn from the freezer. This facilitates cleaner and easier handling, particularly for the production of novelties and the marketing of so-called "soft" ice cream, besides making for improved and more uniform texture in the hardening room. Still other practical advan-

[b] Exclusion by the bread standards order effective August 13, 1952, of polyoxyethylene *(8)* monostearate and other emulsifiers of similar nature, has been stayed, pending decision on a petition for review of this order which is to be heard in the fall of 1952 by the U. S. Court of Appeals for the Third Circuit.

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TABLE 4
Level of emulsifier use

Ice cream	Emulsifier	Av. tech. desirable, customary level	Maximum practical level
ALTERNATES	sorbitan monostearate	0.12%	0.20% [1]
	p.o.e. (20) sorbitan monostearate	0.08%	0.20% [1]
	p.o.e. (20) sorbitan tristearate	0.05%	0.20% [1]
	p.o.e. (20) sorbitan monoleate	0.05%	0.20% [1]
	p.o.e. (40) monostearate	0.05%	0.20% [1]
	Average use	0.08%	

[1] Maximum level proposed for Federal Ice Cream Standards.

tages include savings in whipping time and power and greater uniformity from day to day, freezer to freezer, and with various forms of stored butter fat in use at various times of the year.

(c) *Other Dairy Products.* Table 5 shows two additional dairy products. Just as the whipping of the frozen dairy products is facilitated by the addition of emulsifiers, so also is the whipping of cream. In the now popular cream whip, distributed in pressurized vessels for home, fountain and restaurant use, certain emulsifiers have proved of value. Either polyoxyethylene *(20)* sorbitan monostearate or monooleate is suitable at a customary average level of 0.085%. The maximum practical level in this product, for either of these two emulsifiers, is about 0.12%.

The uniform enrichment of whole, non-homogenized milk with fat-soluble vitamin D requires the assistance of an emulsifier. In the case of homogenized milk, both fresh and canned

TABLE 5
Level of emulsifier use

Miscellaneous dairy products	Emulsifier	Av. tech. desirable, customary level	Maximum practical level
Pressure-dispensed cream whip	p.o.e. (20) sorbitan monostearate or monooleate	0.085%	0.12%
Vit. D enriched whole milk (non-homogenized)	p.o.e. (20) sorbitan monolaurate or monooleate	0.000013%	0.000013%

types, the butter fat serves as the dispersing agent for the vitamin, making an emulsifier unnecessary. But, in the case of ordinary whole milk, a trace of emulsifier is required to prevent all of the vitamin from accumulating in the cream. The vitamin D is usually supplied for this purpose in dispersible form, i.e. with the proper amount and selection of emulsifier for the job. Either polyoxyethylene *(20)* sorbitan monooleate or the monolaurate is suitable, the quantity required being almost too small to mention, namely about ⅛th p.p.m.

(d) *Candies.* Table 6 shows a group of candies in which emulsifiers have found value for various technological functions.

The first item is coatings, such as are used for candy bars, wherein 1% of the coating may consist of a blend of sorbitan monostearate and polyoxyethylene *(20)* monostearate, ranging in ratio from 50:50 to 60:40.

This is for the main purpose of controlling fat bloom in coatings, containing chocolate liquor or cocoa powder, as reported previously by the Lehigh University and the Quartermaster Food and Container Institute groups *(1, 15)*. In addition, these particular emulsifier combinations were found to make it possible, for the first time, to use chocolate liquor in combination with higher-melting fats *(10)*, besides effecting other improvements in coatings designed to withstand the rigors of high temperature storage. Here they not only improve the palatability and eating qualities of such coatings, by reducing the waxy feel in the mouth, but they also make it possible to employ lower melting fats than would otherwise be required to withstand a given set of high temperature conditions.

The next candy item shown in Table 6 is sugar-coated, chocolate ovals. These are coated by the well-known panning operation using sugar syrups containing slightly less than 0.2% of polyoxyethylene *(20)* monostearate. The finished piece of candy usually contains an average of 0.06%, with a maximum practical level of 0.10% of the emulsifier. The technological function of the emulsifier is to reduce the crystallizing time of the sugar coating and to induce the formation of smaller sized crystals—resulting in a more attractive, opaque appearance and brighter colors.

The next item is chewy caramels, in which the palatability and chewing properties are improved by the use of a blend of sorbitan monostearate and polyoxythylene *(20)* sorbitan monostearate, usually in the ratio of 4:1 and a level of 0.5% in the

TABLE 6
Level of emulsifier use

Candies	Emulsifier	Av. tech. desirable, customary level	Maximum practical level
Coated candy bars	50/50 or 60/40 blends of sorbitan monostearate and p.o.e. (20) sorbitan monostearate (incoating only)	0.25%	0.34%
Sugar coated chocolate ovals	p.o.e. (20) sorbitan monostearate	0.06%	0.10%
Chewy caramels	80/20 blend of sorbitan monostearate and p.o.e. (20) sorbitan monostearate	0.50%	0.60%
Hard candies	p.o.e. (20) sorbitan monolaurates or monooleate	0.02%	0.025%

caramel. A maximum practical level is indicated to be 0.6% of this emulsifier mixture. The presence of the emulsifier retards sticking to the teeth and to the wrapper besides improving flavor dispersion and cutting ease, in their manufacture.

In hard candies, emulsifiers may be used for uniform and efficient flavor dispersion; without the use of alcoholic solvents *(47)*. Either polyoxyethylene *(20)* sorbitan monoleate or the monolaurate is used at an average level of 0.02% and a maximum practical level of 0.025%.

(e) *Miscellaneous Items.* Table 7 shows a group of miscellaneous foods. As in the case of hard candies, emulsifiers are used for the dispersion of flavor oils in soft drinks *(48)* and dill pickles *(17)*. The same emulsifiers are applicable, namely, polyoxyethylene *(20)* sorbitan monooleate or laurate at the indicated levels. In soft drinks the emulsifier level averages 0.002% with a maximum practical level of 0.003% and in dill pickles the figures are 0.01% and 0.02%, respectively.

For yeast, a special emulsifier has been developed, consisting of mixed partial fatty esters of sorbitan and glycerol. Amounts ranging from 0.01 to 0.12% are applicable under various con-

TABLE 7
Level of emulsifier use

Miscellaneous Foods	Emulsifier	Av. tech. desirable, customary level	Maximum practical level
Soft drinks	p.o.e. (20) sorbitan monolaurate or monooleate	0.002%	0.003%
Dill pickles	p.o.e. (20) sorbitan monolaurate or monooleate	0.01%	0.02%
Multivitamin drops	p.o.e. (20) sorbitan monolaurate or monooleate	0.06 gr.[1]	0.09 gr.[1]
Compressed yeast	mixed partial fatty esters of sorbitan and glycerine	0.10%	0.12%

[1] Grams of emulsifier in required daily use.

ditions, with an average level of use at 0.1%. The emulsifier serves to improve the uniformity of color and consistency of the yeast, making for reduced crumbliness and better cutting and handling qualities *(62a)*.

For multiple vitamin drops or concentrates *(20, 65)*, either polyoxyethylene *(20)* sorbitan monolaurate or oleate or combinations thereof are used to make them water dispersible. Based on the prescribed daily dose of these concentrates, the amount of emulsifier will average 0.06 gram with a maximum of 0.09 gram per day per person.

Two additional very minor food uses are foam killing and food washing. Sorbitan monolaurate and the trioleate are effective anti-foam agents at extremely low levels in certain specific food boiling operations. For food washing, the polyoxyethylene *(20)* sorbitan monooleate is considered the best selection, used at levels of not more than ¼ of 1% in the wash water. The potential amount of emulsifiers that might be ingested from these sources is considered too small for inclusion in the present study.

From the foregoing data, it will be noted that the technologically desirable amounts of the emulsifiers, as customarily used in each of the food products in which they appear, are below 0.35%, with but 2 exceptions, namely, caramels at 0.5% and sponge cake at 0.7%. Moreover, the maximum practical levels of the emulsifiers are also below 0.35%, with the exception of caramels at 0.6%, sponge cake at 0.81% and sweet rolls and doughnuts at 1.0%.

QUANTITIES BY WEIGHT OF THE EMULSIFIERS THAT MAY BE CONSUMED

Calculations have been made as to the amounts, by weight, of the emulsifiers which may be consumed as the result of these technological additions to the individual foods.

One important consideration is the possible amount of the emulsifiers that may be consumed, based on "Typical Food Portions" of the particular foods to which the emulsifiers are applicable. Table 8 shows a list of typical food portions [k] of each of the foods involved, together with applicable emulsifier data. These data show (a), the technologically desirable and (b) the maximum practical aggregate amounts of the emulsifiers for each typical food portion of these foods. Included in Table 8 are also the amounts of calories contributed by each "typical food portion," as a gauge in viewing these data in relation to a practical or typical overall diet. From these data it is possible for the reader to calculate a wide variety of dietary patterns, including those that might be considered abnormal or unusual, particularly with respect to the proportion of the particular food items in which the emulsifiers might appear.

In order to estimate aggregate weights of the emulsifiers that may be consumed, one must know the amounts of each of the foods involved in the diet. Investigation indicated that the most comprehensive overall food consumption data were available from the U. S. Department of Agriculture, Bureau of Nutrition and Home Economics. The latest food consumption survey statistics available from this source (year 1948) *(72)* and additional 1948 data from the U. S. Department of Agriculture, Bureau of Agricultural Economics *(73)* were accordingly used as the basis of estimates concerning the possible long-range daily ingestion of the emulsifiers, per capita. Various assumptions were necessarily made for the purpose of making these calculations.

The average food consumption statistics, obtained from these sources, were used for calculating the data shown in Table 9. From these statistics, it was possible to calculate the average weights, in grams, of various individual types of food, consumed per person per day. From these data, the amounts of emulsifier (grams) per person per day were calculated (a) assuming that each food, to which they were applicable, contained its customary or technologically desired level and (b) assuming that each of these foods contained its maximum practical level. A summary of these data is shown in Table 9.

The aggregate amount of the emulsifiers, per person per day, was found to be about 0.482 gram on the basis of their being used in all applicable foods at the usual levels and assuming that all of these foods are con-

[k] The listed data, pertaining to typical food portions, were largely taken from the booklet published in 1950 by the H. J. Heinz Company, entitled "Nutritional Data." With respect to the caloric and dry weight values shown, they have been found to be consistent with data published in the U. S. Dept. of Agr. Handbook No. 8, June 1950, entitled *Composition of Foods, Raw, Processed, Prepared*, by B. K. Watt et al.

TABLE 8
Typical food portions and applicable emulsifier data

Food item	Typical food portion			Grams of emulsifiers per typical food portion	
	Measure	Calories	Grams	Desirable	Maximum practical
Breads	3 slices	180	69	0.173	0.235
Rolls	1 roll	100	32	0.080	0.109
Sweet rolls	1 roll	100	32	0.109	0.320
Doughnuts	1-3"	213	50	0.170	0.500
Cake (shortening type)	1 slice	100	30	0.081	0.096
Cake (sponge type)	1 slice	75	25	0.175	0.203
Ice Cream	½ cup	210	100	0.080	0.200
Pressure-dispensed cream whip	½ oz.	46	14	0.012	0.017
Coated candy bar	1 bar	297	60	0.150	0.204
Sugar coated chocolate ovals	25 pcs.	185	37	0.022	0.037
Chewy caramels	2 pcs.	133	32	0.160	0.192
Hard candy	10 pcs.	153	40	0.008	0.010
Soft drinks	7 oz.	96	200	0.004	0.006
Dill pickles	¼ large	5	50	0.005	0.010
Vit. enriched whole milk	½ pt.	165	240	0.00003	0.00003
Vit. drops (water-dispersible)	Average daily requirement			0.060	0.090

TABLE 9
Average consumption and applicable emulsifier data for various types of foods

Food product	Grams food per person per day	Possible consumption grams emulsifier per person per day	
		Customary average level	Maximum practical level
Ice cream	21.3	0.01704	0.04260
Breads, rolls and biscuits	121.7	0.30425	0.41378
Cake (all kinds)	8.9	0.03382	0.03916
Sweet rolls, buns, cookies, and doughnuts	14.5	0.04930	0.14500
Soft drinks	63.0	0.00126	0.00189
Candies (all kinds)	6.9	0.01449	0.01835
Dill pickles (⅓ total pickles and olives)	2.3	0.00023	0.00046
Yeast	0.136	0.00014	0.00016
Vitamin drops (prescribed daily dose)		0.06000	0.09000
Vit. enriched whole milk	383.3	0.00005	0.00005
Totals	622.036	0.48158	0.75145

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sumed in their normal average proportions with respect to the entire diet.

The aggregate amount of the emulsifiers, on the basis of their being used in each of the several foods at their maximum practical levels and assuming the normal proportions of these foods in the diet, was found to be about 0.751 gram.

QUANTITIES BY PERCENT OF DIET OF THE EMULSIFIERS THAT MAY BE CONSUMED

In the U. S. Dept. of Agriculture report (FE 719) *(72)*, data from which were taken for the overall average diet calculations shown in Table 9, the average consumption of food, per capita per day in 68 cities of the United States in the spring of 1948 amounted to 4.344 pounds, or 1975 grams. Calculations, based on this 1975 g.[1] figure were made to observe the percentage of the emulsifiers in the entire diet. For estimations on a "dry basis," 600 g.[1] total daily per capita food consumption were used.

Calculated in relation to these figures, it may be seen that the total amount of the emulsifiers likely to be ingested daily (0.482 gram) will normally be about 0.024% of the entire diet and about 0.08%, dry basis. Moreover, if each food should contain its maximum practical amount of the emulsifiers, the aggregate amount (0.751 gram) calculates to be 0.038% of the entire average, normal diet or 0.125%, dry basis.

An inquiry might be raised as to the possible aggregate amounts of the emulsifiers ingested from abnormal diets. The type of abnormal diet, which is of chief concern here, is that in which there would be a greater than normal proportion of the group of foods in which the emulsifiers may appear.

An extreme and very impractical, hypothetical situation (at least for very long at a time) would be that in which the entire diet consists only of the group of foods containing the emulsifiers. The overall average percentages of the emulsifiers in this group of foods only would be indicative of the possible aggregate emulsifier contents of this extreme hypothetical dietary situation. Based on the per capita consumption spectrum for the group of foods in which the emulsifiers may appear, calculations show an average overall customary level of 0.077% of the emulsifiers in this group only. Excluding milk, the overall average customary level of the emulsifiers in this group of foods only is calculated to be 0.202%. At the maximum practical levels for each food of this group, the overall average possible content of emulsifiers—in this group of foods only—is calculated to be 0.121% including milk and 0.315%, excluding milk.

Also, by considering the calories contributed by this group of foods, in their normal consumption spectrum proportions, it is possible to estimate the aggregate amounts of the emulsifiers that might be ingested per person per day, should the diet consist of this group of foods only. For example, on a 3000 calories per day basis, it may be calculated that a diet consisting of this group of foods only, would include 1.9 g. of emulsifiers per day, at customary levels, and 2.96 g. at maximum practical levels. On this same basis, but excluding milk from the diet, the aggregate amounts of the emulsifiers are calculated to be 2.85 g. at customary levels and 4.45 g. at the maximum practical levels for the emulsifiers.

By extensive testing in human subjects as well as in animals, it has been shown that these emulsifiers have no demonstrable biological effects at levels considerably above 1% of the diet *(2, 3, 6, 7, 11-14, 23, 28-30, 34-36, 38, 41-43, 45, 50, 52-55, 61, 63, 67, 70, 71)*. Therefore, should it be deemed desirable, consistent with the practice of limiting the permissible concentrations of chemical additives in food, a maximum of 1% of these emulsifiers would provide a wide margin of safety. Moreover, it will be observed from the data presented herein, that there exists a large margin between a 1% maximum limit and the indicated maximum aggregate amounts of emulsifiers likely to be ingested.

[1] This figure was checked with nutritionists who agreed that it was representative of actual experience.

SUMMARY

The general nature and technological values are briefly described, of 11 partial-ester, non-ionic food emulsifiers which are added to certain foods in very small amounts to impart special improvements. They include certain sorbitan partial esters of fatty acids, certain polyoxyethylene derivatives thereof and certain polyoxyethylene derivatives of fatty acids.

The total amounts of these various emulsifiers (per cent) required in the individual foods, to perform the technological functions desired, are shown a, at the customary, desired levels, and b, at the maximum practical levels. In all but a few minor cases, the levels are less than 0.35% of the food product.

The quantities, by weight, of the emulsifiers that may be consumed are shown a, for typical food portions of the individual foods involved and b, for the total average normal diet. The possible total consumption of the emulsifiers, per person per day in the normal average diet, is of the order of ½ gram, at customary levels of use, and about ¾ gram at maximum practical levels of use in all of the foods involved.

It is shown that the total amount of the emulsifiers likely to be ingested in the normal average diet will be about 0.024%, as is, or 0.08%, dry basis, with a maximum practical limit of about 0.038%, as is, or 0.125%, dry basis. Considerable margin is accordingly indicated, even though a maximum permissible limit might be set not higher than 1.0% of the diet.

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Improvements in the Candying of Fruits[a,b]

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A study was made of two syrup evaporator designs for candying fruit. The tubular type was found to be 3 to 4 times more efficient than the cascading tray type. Results of an investigation of dyes, dyeing procedures, discoloration due to metallic ions, and factors involved in maintaining a mutually soluble sucrose-invert sugar ratio in the syrup are presented. Recommendations for some factory procedures are given.

Since the two senior writers published a series of articles in the *Fruit Products Journal* in 1941 on the candying of fruit *(4)*, a number of improvements in the process have been devised, particularly with respect to syrup concentration by evaporation, dyes and methods of dyeing, and maintenance of satisfactory sucrose-invert syrup ratios. The term candied fruit as used in this paper refers to fruits impregnated with sugar syrup for use by bakers in cakes or fruit breads. Glacé or crystallized fruit are two other names frequently given such products. Basically the process involves blanching or leaching; dyeing the fruit with a pure food dye; and impregnating with sugar syrup until the total soluble solids are in the range of 72 to 74%. The ratio of sucrose to invert is maintained at 1:1 to 3:2 in order to prevent crystallization. The process is carried out in such a manner that the final product is tender and not shrivelled.

Investigations resulting in improved syrup evaporator design, dyeing, syruping technique and control are reported in this paper.

SYRUP EVAPORATORS FOR CANDIED FRUIT

The hot continuous method developed by Atkinson and Strachan *(4)* of syruping fruit for use in bakery products is based partly on the use of a syrup evaporator that will gradually concentrate the syrup and partly on maintaining a temperature of 140° F. (60° C.) in the product. A 1% concentration per hour is recommended for 8 hours per day. This procedure effects two purposes: a, fermentation is prevented, and b, the sugar is absorbed more quickly and yet without causing shrivelling of the fruit. The evaporation method was found to be much more economical to install and operate than the older method employing vacuum pans and operating on a batch basis. However, as originally designed, the evaporator became the limiting factor in the process. Hence this phase was re-investigated with the object of designing equipment with greater capacity and to provide simpler, more efficient operation. Two types of evaporators have been designed (Figures 1 and 2).

Cascading tray type. Figure 1 illustrates a unit of the cascading type. An enclosed aluminum[c] tunnel has a unit steam heater located at one end. The unit-heater provides a flow of warm air at 130° to 140° F. (54.4° to 60° C.). The overall dimensions of the tunnel are as follows: 15 inches deep, 34½ inches wide and 6 feet 6 inches long. The tunnel is filled with shallow trays, ½ inch deep, 12 inches wide and 34 inches long. There are four layers of these trays and they are so arranged that the syrup cascades from one tray to the next. The syrup from the tanks of fruit is distributed in the rectangular trough above the lid. This trough has 6 openings of ½ inch diameter. Syrup delivered to this trough has already been heated in a tubular stainless steel heater to 140° F. (60° C.) and should be reheated again to this temperature with an auxiliary heater as the syrup leaves the evaporator. The evaporator will remove 58 pounds of water per hour, which is at the rate of approximately one pound of water per square foot of evaporating surface. A unit of this cascading tray type of syrup evaporator has been tried under factory conditions and found to be reasonably satisfactory.

Figure 1. Cascading tray type syrup evaporator.
a, distributing trough.
b, c, d, and e, shallow aluminum pans.
k, j, and i, lids.
h, converging side of the short funnel leading to the heating unit and fan.
f, syrup accumulating tank.
g, steam trap below the unit heater.

Tubular type. In Figures 2 and 3 a tubular evaporator heated with steam is shown. It consists of 12 two-inch aluminum tubes 6 feet 8 inches long with 6 feet effective evaporating length in each tube. From syrup delivered at 140° F. (60° C.), 170 pounds of water per hour can be evaporated with this equipment and still maintain a leaving temperature of 140° F. (60° C.). Low pressure steam or hot water is passed through the tubes while syrup is distributed by means of 2 troughs above this equipment. The top trough is approximately 5 inches wide and 3 inches deep (inside dimensions). It contains nine ⅜ inch holes spaced evenly in the trough. The second, or lower trough, is of the same overall dimensions, but is divided into 9 compartments. One-eighth inch holes are spaced ¾ of an inch apart in this trough. Sheets of aluminum are placed on the sides away from the tubes to prevent splashing onto the floor.

With the tubular evaporator not very much difference was found in the rate of evaporation for syrups of different concentrations. The fact that the syrup temperature can be maintained as it flows over this equipment makes a tremendous difference in efficiency. By increasing the number of tubes to 15, the first 3 in the evaporator will act as a preheater to raise the temperature of the syrup coming from the tanks to the desired

[a] Contribution No. 793 from the Division of Horticulture, Experimental Farm Service, Ottawa.

[b] Presented at the Twelfth Annual Meeting of the IFT, Grand Rapids, Michigan, June 11, 1952.

[c] Aluminum was used in developing designs of equipment because of availability, cost and ease of fabrication. Stainless steel No. 316 is recommended for commercial use.

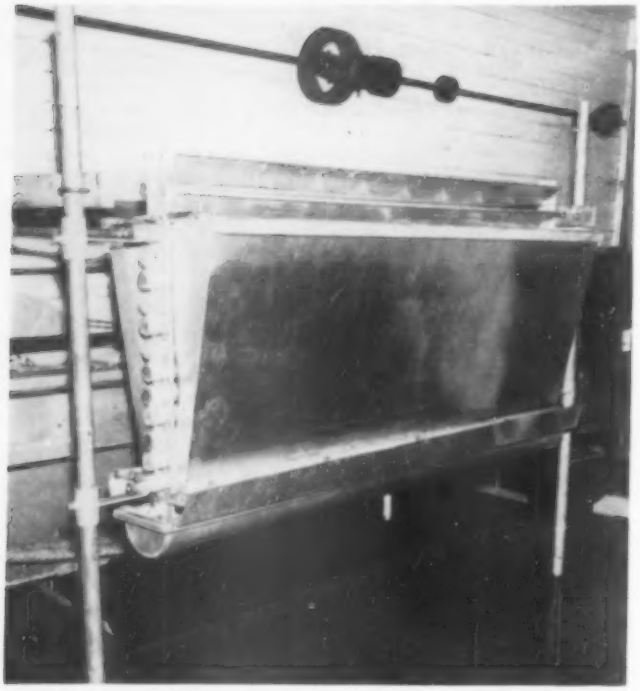

Figure 2. Tubular type syrup evaporator as it appears in operation.

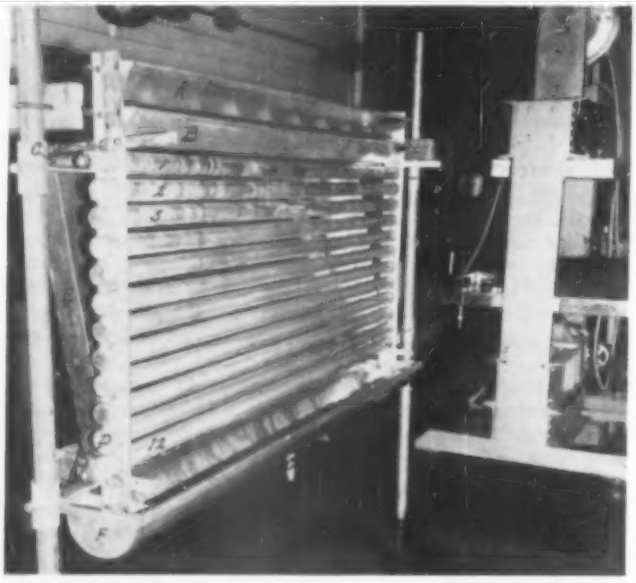

Figure 3. Tubular type syrup evaporator with one splash baffle removed.

A, syrup distributing trough, 9 only, 3/8-inch holes.
B, syrup distributing trough, 1/8-inch holes on 3/4-inch centers.
C, steam inlet.
D, steam condensate outlet.
E, splash baffle.
F, syrup trough.
G, syrup outlet (automatic control bulb to regulate steam inlet).

140° F. (60° C.). Figure 4 illustrates the suggested design of a 15-tube evaporator.

The capacity of the tubular equipment per square foot is almost 4 times that of the tray evaporator. There is also the advantage in the tubular type that the syrup leaves at 140° F. (60° C.) and does not require an auxiliary heater. However, the distributing system requires careful screening of the syrup to remove small particles. Otherwise the flow of syrup over the tubes is uneven with resultant loss in evaporation. Under commercial trials the 12-tube evaporator (Figures 2 and 3) is proving very satisfactory with cherries.

The circulating evaporating system for syrups has proved satisfactory in all cases except with fruit such as zucca melon or small pieces of peel which absorb the sugar from the syrup very rapidly and sink. This makes it very difficult to drain or pump the syrup from the tanks of fruit. A slowly revolving eliptical cylinder made of perforated stainless steel is now being investigated as a possible means of separating the fruit from the syrup so that the syrup may be continually pumped from the tanks.

DYEING OF CHERRIES AND ZUCCA MELON

Due to a much wider range of colors now being permitted under the Canadian Food and Drug Regulations and to changing ideas of suitable colors on the part of buyers, it was considered desirable to reinvestigate the kind and quantity of dyes as well as the dyeing procedure for candied fruit and maraschino cherries. The results of this study are summarized in Table 1.

TABLE 1

Recommended amounts of pure certified food dye for each 100 pounds of fruit

Product	Dye	Amount of dye in grams	Dyeing procedure
Candied Cherries Red	Erythrosine	5	Add dye to neutral 30% sucrose syrup at start of candying process. After 24-48 hours when dye has penetrated, acidify with citric acid to pH 3.6. Adjust syrup daily to pH 3.6-3.75 for normal color.
	Ponceau SX	12	Add dye to first syrup at start of candying process. If old syrup containing some color is used then quantity of dye added would have to be adjusted accordingly. Acidify syrup with citric acid to pH 3.6-3.9.
	Ponceau 3R	9	As for ponceau SX.
Green	Light Green S.F. Yellowish	3	As for ponceau SX. (Equal quantities of the two dyes gives a desirable green shade).
	Tartrazine	3	
Yellow	Tartrazine	8	As for ponceau SX.
Maraschino Cherries Red	Ponceau 3R	25	As for candied cherries.
	Ponceau SX	30	As for candied cherries.
	Erythrosine	15	As for candied cherries. (not generally used)
Green	Light Green S.F. Yellowish	5	As for candied cherries.
	Tartrazine	5	
Candied Zucca Melon Red	Erythrosine	7	As for candied cherries.
	Ponceau SX	9	As for candied cherries.
	Ponceau 3R	6	As for candied cherries.
Green	Light Green S.F. Yellowish	4	As for candied cherries.
	Tartrazine	4	
Yellow	Tartrazine	8	As for candied cherries.

Dyes. Some variation from the recommended dye quantities given in Table 1 may be made according to processors' own requirements and possible variations in natural pigments of the sulphured stock. The 3 red dyes each give characteristic shades. Ponceau SX is particularly suitable where the original cherry is dark due primarily to overmaturity. Dye in amounts greater

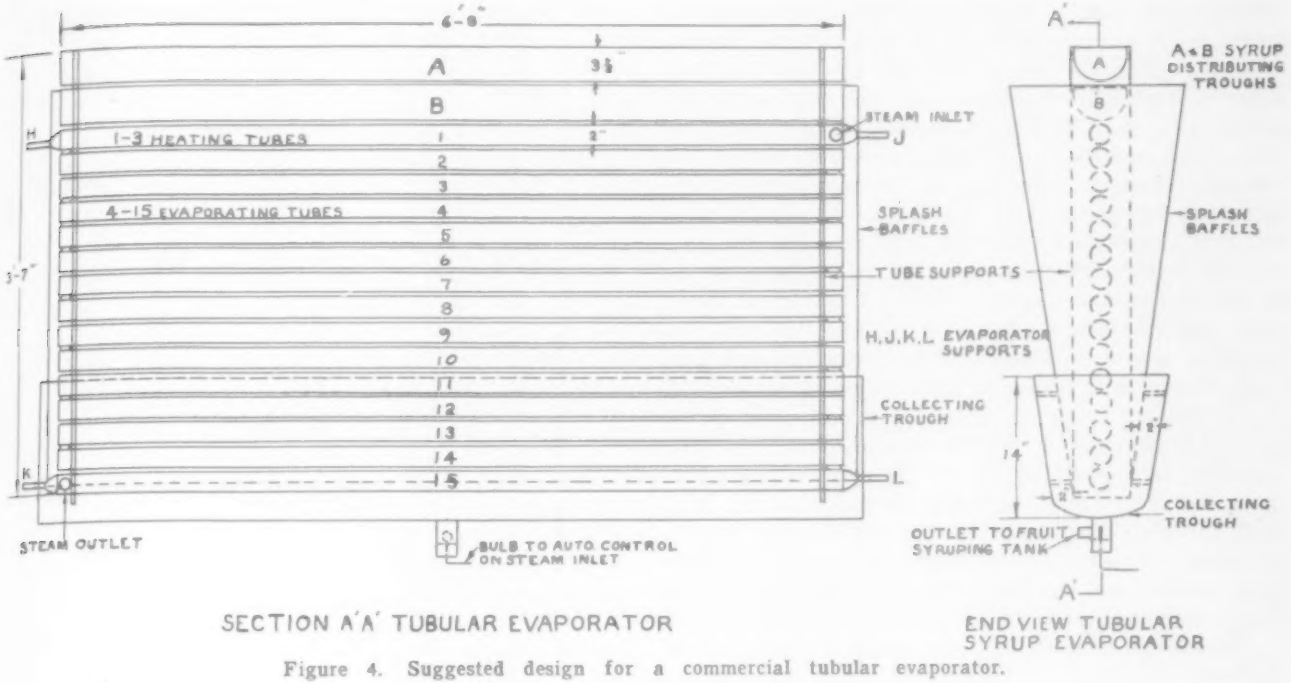

Figure 4. Suggested design for a commercial tubular evaporator.

than those recommended will give deeper shades but not in proportion to the amount of dye added with maxima soon being reached where additional dye results in no color increase and tends to impart a dull, unattractive appearance. Erythrosine dye cannot be used to give a deep red. Ponceau 3R shows greater darkening in storage than ponceau SX. Erythrosine is the most stable.

Dyeing procedure. The dyeing procedure for the acid soluble dyes, ponceau, light green S. F. yellowish and tartrazine is unchanged from that previously recommended except that the syrup is acidified to pH 3.6 to 3.9 in order to control sucrose-invert ratio as will be discussed later. This pH range gives satisfactory color.

The procedure for dyeing with the acid insoluble dye, erythrosine, has been changed so that it is possible to carry out the dyeing in the syrup in a similar manner to that with the acid soluble dyes. The solubility of erythrosine decreases rapidly below pH 4.0, the dye being completely precipitated or set at pH values below 3.5 *(5)*. It is, however, completely soluble above pH 4.0 until strongly alkaline conditions are reached when it is again precipitated. Therefore the fruit to be dyed with erythrosine is leached in the usual manner in 10 minute changes of boiling water *(4)* to remove the SO_2, condition the tissue for syruping, and particularly to develop a pH in the fruit in the range of 4 to 4.4. This is essential for satisfactory dye penetration. Over-leaching is also to be avoided. Following leaching the erythrosine dye is added to neutral 30% sucrose syrup in the candying tanks for a period of 24 to 48 hours at 140° F. (60° C.). The dye should completely penetrate the cherry flesh in this time. The syrup is then acidified with citric acid to pH 3.6 and maintained at pH 3.6 to 3.7. Above pH 3.75 the color will not be normal. As will be shown, these pH ranges permit a satisfactory sucrose-invert ratio with syruping temperatures of 140° F. (60° C.). The benefits of this new method of dyeing with erythrosine are as follows: a, factory operation is simplified; b, less dye is required; c, better penetration of dye is obtained; d, dyeing is more uniform; e, time is saved by eliminating the 45-minute dyeing boil.

Discoloration due to metallic contamination. Atkinson and Strachan *(3)* first reported the effect of various metals on the color of erythrosine dyed cherries. Quantitative data have now been obtained on the concentration of certain metallic ions causing discoloration of erythrosine dyed fruit. It is apparent that more than 8 p.p.m. of copper in the finished product will adversely affect the erythrosine dye. Nickel up to 80 p.p.m. did not produce color deterioration and in one case 7 p.p.m. nickel inhibited discoloration by 40 p.p.m. of copper. This occurred in the case of monel. Finished cherries containing 35 p.p.m. of aluminum still maintained a satisfactory color as did those containing up to 3 p.p.m. of iron. Reduction of dye by 30 p.p.m. of dissolved tin resulted in bleaching of the product. Ionic copper apparently reacts both with the dye and with the fruit tissue as it will cause discoloration of the cherries in the absence of dye.

Studies are presently in progress on the effect of metallic ions on the color of the other dyes. It would appear that larger amounts of copper are required to cause discoloration with ponceau dyes. For instance up to 35 p.p.m. of copper can be present with ponceau SX and up to 40 p.p.m. with ponceau 3R before serious discoloration is encountered. The possible use of sequestering agents such as gluconic acid or calcium phytate are being investigated to determine their effect in correcting a condition where copper contamination has occurred. Copper equipment should be avoided as only a few parts per million will cause some discoloration.

SUCROSE - INVERT SYRUP RATIOS IN CANDYING OF FRUIT

It has been common practice among baker's fruit manufacturers to use a considerable amount of 43° baumé glucose in order to prevent crystallization. Commercial glucose, however, contains 18 to 19% water, 38 to 40% dextrose and 41 to 44% dextrin and other partially hydrolized starch products. Analysis of a candied fruit in which glucose has been used may show the sugar content to be only 50 to 55% which can permit spoilage. By using invert sugar to replace the glucose the analyzable sugar can be raised to 70 to 75%.

For sugar to be a preservative, a concentration of at least 66% is required. Consequently, the use of glucose tends to encourage the employment of preservatives such as sulfur dioxide and benzoate of soda. In a finished product having a total sugar content of 70 to 75%, greatest stability may be expected with a sugar ratio of 1:1 to 3:2 of sucrose to invert *(6)*. Both laboratory and commercial experience have confirmed this.

Obtaining the correct sugar ratio with invert syrup involves much more control on the part of the manufacturer than does the use of glucose. The use of invert sugar is especially desirable with the continuous hot process now used by most Canadian manufacturers, as part of the sucrose sugar becomes inverted during the normal operation of the process. Employment of only sucrose-invert syrups with the hot, continuous process was first suggested by Atkinson and Strachan *(2)*.

With erythrosine dyed fruit low pH concentrations of 3.5 were recommended previously to give a bright color and completely set the dye. This low pH has caused a serious problem of over-inversion resulting in an excess concentration of dextrose which crystallized in the finished product. This is especially true if the product is subjected to low storage temperatures. The condition is aggravated as the process continues because the syrup from one batch is used with the next. With the other dyes the problem is not so acute because the lower pH values are not required in order to give a good color. Care, however, must be exercised in order that inversion is sufficient to prevent crystallization of sucrose which would be more serious than that of dextrose.

Because of these problems an investigation was made to obtain information which would permit more accurate control of inversion in factory operation. The relationship of pH to rate of inversion as influenced by temperature, sugar concentration and period of time were studied under conditions simulating those employed in the manufacture of candied fruit. Limited tests of the apparently most desirable procedures were made under commercial conditions.

EXPERIMENTAL PROCEDURE

Liter samples of sucrose syrups of 30, 50 and 70% strength were buffered to pH 3.00, 3.50, 3.75, 4.00 and 4.50 and held at constant temperatures of 120°, 140°, and 160° F. (48.9°, 60°, and 71.1° C.). Evaporation from these samples was prevented and no other sugars or syrups were added. Aliquots were taken daily for analysis. It was found essential to buffer the sucrose syrups, particularly the 3.5 and 3.0 pH samples as there was a tendency to continual pH increase. The Lane and Eynon volumetric method *(1)* was employed for determining sugar. The pH values were determined with a Beckman glass electrode pH meter. Sodium citrate was used for buffering.

To simulate commercial conditions, samples of cherries were candied by the continuous evaporation process at 140° F. (60° C.) employing: (a) initially, a 30% cane sugar solution and continually making up the amount evaporated by adding fresh sucrose sugar syrup at the same approximate strength as on the fruit, (b) initially, a 42% inverted syrup of 30% total strength with this partially inverted syrup being used for the first 2 days to maintain the syrup level on the fruit followed by sucrose syrup to the end of the process. In each case the syrups were adjusted to pH concentrations of 3.50 and 3.75.

RESULTS AND DISCUSSION

Typical data obtained on the interrelationship of pH, syrup concentration, temperature and length of treatment of sucrose syrups of constant volume are presented graphically in Figures 5, 6 and 7. It is apparent from Figure 5 which shows the effect of pH on the inversion of a 50% sucrose syrup at 140° F. (60° C.) that a desirable pH range under commercial conditions most likely would be between pH 3.5 and 4.0. Figure 6 illustrates the marked effect of temperature on inversion. If a temperature of 150° F. (65.6° C.) was practical, pH values greater than 3.75 would have to be employed. However, a temperature of 160° F. (71.1° C.) causes caramelization in the syrup, 140° F. (60° C.) being near the maximum for safety, particularly in concentrated syrups. Much lower pH values could be used at 120° F. (48.9° C.) but experience has shown that syrups at these temperatures under commercial conditions are subject to fermentation. As indicated in Figure 7 the rate of inversion is slightly faster in syrups weaker than 50% and slower in syrups of concentrations greater than that. The rate of inversion was found to decrease rapidly under any one set of conditions as per cent inversion exceeded 80. Table 2 further summarizes some of the interrelationships found in this investigation.

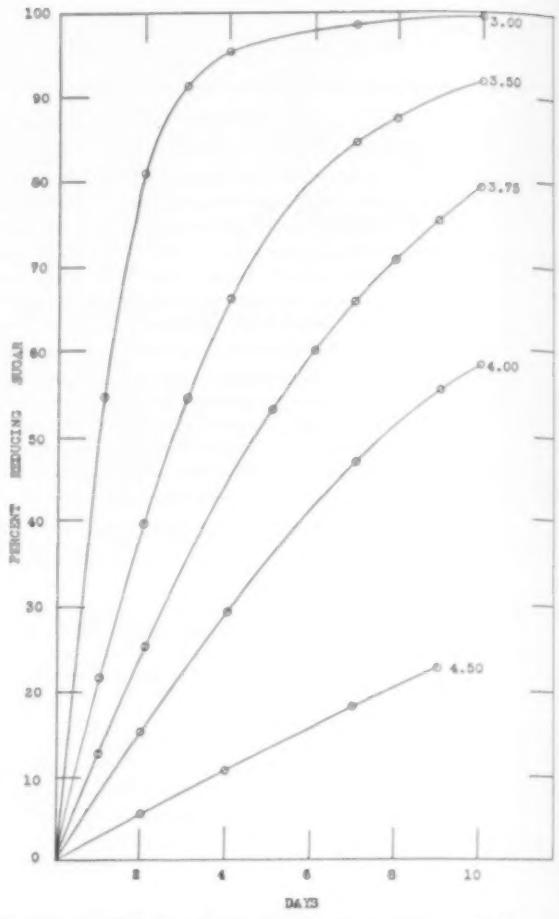

Figure 5. Effect of pH on the inversion of 50% sucrose syrup at 140° F. (60° C.).

TABLE 2

Effect of pH and temperature on degree of inversion

pH	Percent of sucrose inverted in an initial 50% sucrose solution after 7 days at constant temperature of		
	120° F.	140° F.	160° F.
	%	%	%
3.00	79	98	99[a]
3.50	38	85	99[b]
3.75	26	66	96
4.00	15	47	89
4.50	7	18	49

[a] Reached this value in 5 days.
[b] Reached this value in 6 days.

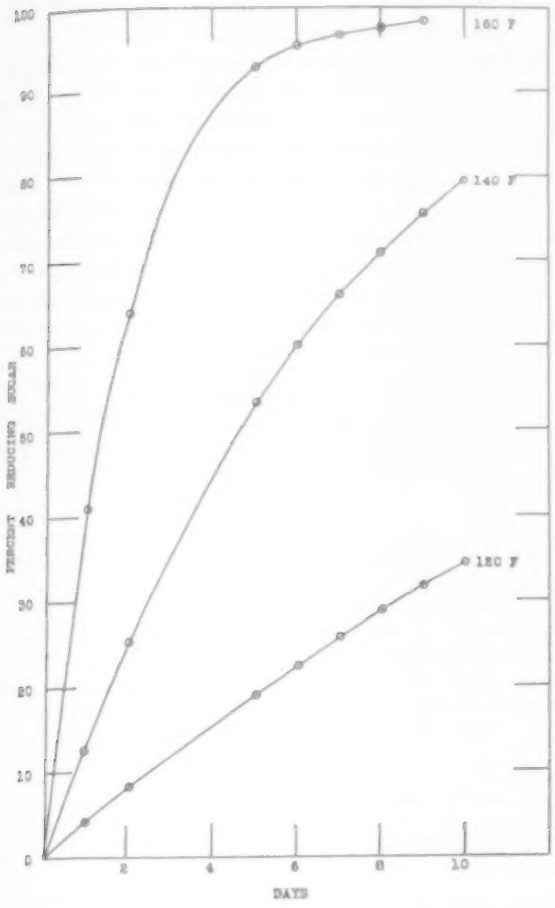

Figure 6. Effect of temperature on the inversion of 50% sucrose syrup at pH 3.75.

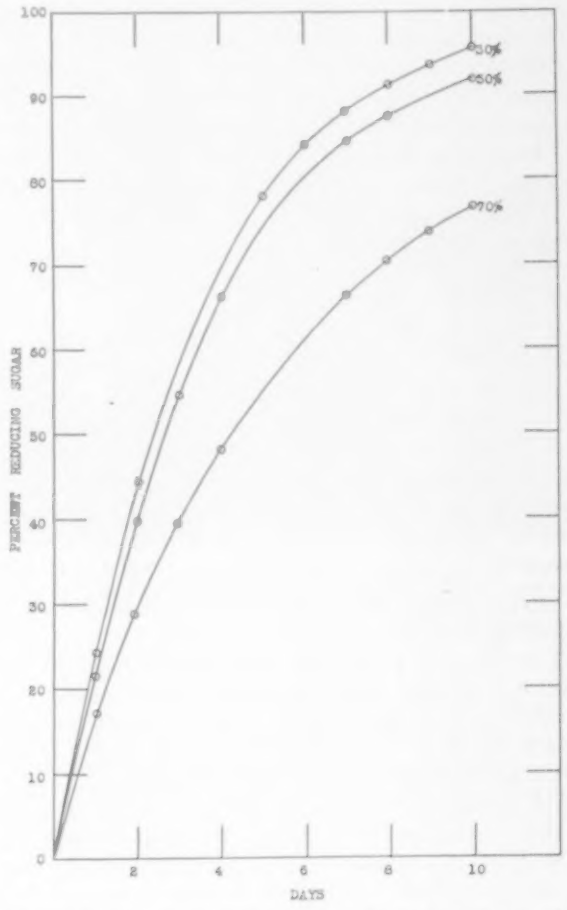

Figure 7. Effect of concentration on the inversion of sucrose syrups at pH 3.50 and 140° F. (60° C.).

Inversion of sugar in syrups at 140° F. (60° C.) during the candying of cherries is shown in Figure 8. Graphs No. 1 and 3 simulated more closely typical commercial procedures where a partially inverted syrup would be used initially for the first 2 or 3 days, probably followed thereafter by the addition of sucrose syrup. The data indicate that a pH close to 3.7 likely would be found to be near the optimum point under continuous operating commercial conditions. Further laboratory and limited commercial trials indicated this to be fairly true.

Depending upon conditions a range of pH 3.6 to 3.9 appears to be satisfactory for all the dyeing and syruping except for erythrosine. With erythrosine, which as previously pointed out requires a neutral syrup for dye penetration for the first 1 to 2 days, the pH should be rapidly lowered to 3.6 and never allowed to exceed 3.75. The syrup will require acidifying for a few days since the pH tends to increase due to equalizing with the more alkaline fruit. If erythrosine cherries reach a sugar concentration of 50% with a pH exceeding 3.75 the color will tend to be increasingly bluish to purplish. If this point has just been reached it may be possible to regain the bright normal red shade with a moderate increase in acidity. However, if the change has progressed too far it is impossible to regain the true color.

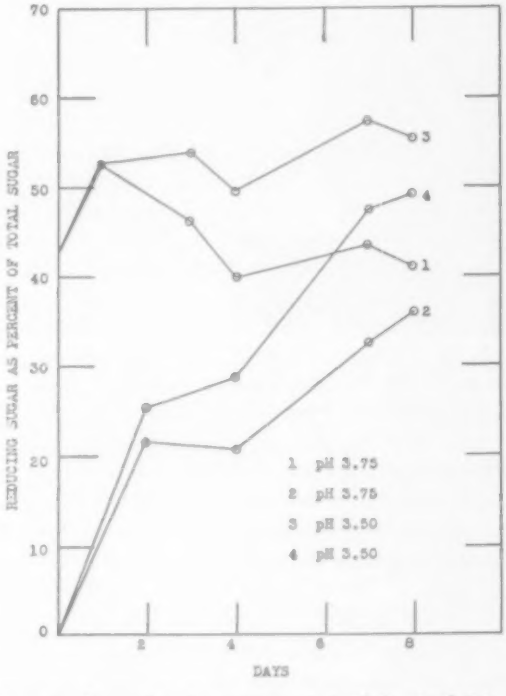

Figure 8. Inversion in syrups at 140° F. (60° C.) during candying of cherries.

Application of the information obtained in this investigation permits accurate control of inversion in factory operation where they are employing the hot, continuous evaporation procedure with a sucrose-invert syruping system. It also will result in a good colored and otherwise satisfactory product. The conditions of pH and temperature suggested reduce the possibility of caramelization of the syrup with consequent undesirable flavor and discoloration.

SUMMARY

A study was made of two types of syrup evaporator designs. The first involved a heated tunnel containing 4 layers of shallow pans so placed that the syrup from the higher layers flowed into trays in the next layer. A blast of air at 140° F. (60° C.) passed over the trays. The second evaporator was made of a stack of 2 inch aluminum tubing in a horizontal position heated by steam or hot water. The syrup flowed over the outside surface of the tubes. The efficiency of the latter design was 3 to 4 times that of the former per square foot of evaporating surface.

A revision of previously recommended quantities of dyes for candied fruit has been made. Studies on metallic contamination showed that 8 p.p.m. of copper caused discoloration of erythrosine dye while 35 to 40 p.p.m. affected ponceau SX and ponceau 3R.

The use of invert sugar to replace commercial glucose in the continuous hot process has been discussed. A proper ratio of sucrose to invert was maintained by control of pH and temperature.

The recommended ratio varied from 1:1 to 3:2 of sucrose to invert. The use of invert to control crystallization made possible a much higher total sugar content.

A new method of dyeing cherries with erythrosine has been described in which the fruit was leached to pH 4.0 to 4.4 and placed in a 30% sucrose syrup containing the dye. The temperature of the syrup was maintained at 140° F. (60° C.). After the dye penetration was complete, usually 24 to 48 hours, the syrup was acidified to pH 3.6 to 3.75. This method used less dye and obtained better penetration of dye than older methods.

Acknowledgments

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Warfarin and Perimeter Rodent Control[a]

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Early Latin history tells us about a Mrs. Toffana and her sorority dedicated to the removal of husbands. Arsenic, which formed the essential ingredient of this original version of "Arsenic and Old Lace," has been replaced by other more effective poisons through the ages. It has not been until this century, however, that real strides have been made in reducing the numbers of rodents. In 1923 red squill was introduced to this country and, due to the rare phenomenon of being a selective rodenticide, it still maintains a high place on the list of rodenticides. About ten years later, zinc phosphide was first tested. It also remains an effective rodenticide, for this form of the chemical retains the attractive odor of phosphorus without the disadvantage of fire hazards. World War II saw the arrival of *antu* (alphanaphthylthiourea) and Compound 1080 (sodium fluoroacetate). These lethal rodent killers are highly effective under certain conditions. The latest poison to join the group (in 1950) is warfarin.

Warfarin is distinctive in that it represents a shift of basic thinking on the nature of rat and mouse poisons. Previously, the proverbial path was beaten to the door of the poison that would kill quickly with a minimum dosage. The effectiveness of warfarin and other anticoagulants is based on the administration of the poison in continuous sub-lethal amounts. A lethal dose is obtained only by a number of successive feedings. In general, it takes 3 to 9 days to kill rats and may require up to a month to kill house mice. Warfarin kills by interfering with the formation of prothrombin (the blood-clotting agent in the circulatory system). Death results from shock induced by internal hemorrhage. The chief advantage of warfarin seems to be the inability of rats and mice to detect it as an undesirable ingredient of the bait. With most other poisons, the rodents become bait shy due to the decided taste or odor of the poison and the rapid realization that all is not well as the poisoned members of the colony exhibit violent symptoms. The slowness of warfarin's action permits an operator to wipe out an entire rat colony without awakening this bait-shyness reaction.

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Thus, warfarin has come to play an important part in most rodent control programs. Notice that precautionary phrase *"important part."* No poison, including warfarin, strikes at the fundamentals of rodent control. The rat population in any given area, like other wild animals—be it foxes, pheasants, skunks or others—is dependent upon the amount of food and cover available. Reduce the sources of food and the animals must starve or move to an environment more to their liking. Reduce the available cover and they must seek other places in which to raise their young and escape from countless enemies. Therefore, a *good* rat control program takes into consideration these fundamentals and requires the practice of sanitation and essential ratproofing. Reductional methods are temporary expedients and should only supplement the control of food and cover.

Perimeter Control

The second part of this title is called "perimeter rodent control," a high-sounding phrase to disguise an elementary biological principle. Rats and mice are continually moving and being moved. In the process they naturally gravitate from areas of high populations to those of low concentrations. Thus, "rodent pressure" from the areas surrounding a food plant means that a control program is not complete unless it takes into consideration the surrounding locality. The success of corrective measures within a plant is dependent to a great extent on the control methods exerted outside the installation.

Consider the sources of re-invasion. Municipal and private dumps have long been a classic breeding ground for rats. However, farm buildings and outlying fence rows and fields with their stored feed and unlimited harborage are not to be discounted. Railroad sidings and waterways are other excellent reservoirs for rats. In urban situations, shopping centers, blighted areas and even good residential sections may contribute to the rodent population.

Perimeter control, then, should extend as far as practical beyond the physical confines of the plant. While many of these areas lie beyond the jurisdiction of the plant, the political and social power of the plant management should not be overlooked. In most localities the processing plant is an important segment of the community. Pressure can be brought to bear for city and county rat control programs. Aid and encouragement of these projects by the plant management will do a great deal towards successfully achieving the objective of reducing the numbers of rodents that may eventually find their way into the plant.

The next line of defense lies on the ground directly administered by the plant. Old outbuildings that no longer serve any useful purpose should be torn down. Private dumps should be continually covered with clean fill. Supplies and stockpiles should be stacked so as to permit an open space of twelve to eighteen inches beneath. Rats do not like to set up housekeeping in the open. Burrows of established colonies along ditch banks and railroad sidings should be gassed, destroyed and checked regularly. Closely-cropped lawns discourage rodent travel toward the plant. If borders planted to shrubs are essential to good landscaping practices, they should be kept trimmed and clean. Establishment of outdoor bait boxes along these lines of travel will do much to discourage rodent invasion. In a midwestern food-processing plant, good ratproofing had eliminated rats, but mice continued to be a problem. A trapping program accounted for 60, 80, and 120 mice in the late fall months of 1947, 1948 and 1949 respectively—when rodent movement was the greatest. In March 1950 this trapping program was supplemented by the placement of 6 bait stations containing warfarin at various points *outside* the plant. Only 2 mice were taken in the fall of 1950 and 1951.

Baiting considerations. Outdoor bait boxes can be made in a variety of shapes and sizes. In general, they should have openings of about 2½ to 3 inches in diameter to permit rats and mice to enter, but keep other animals out (Figure 1). They should be large enough to accommodate a good-sized container to hold the necessary bait and permit the rats freedom of movement. One recommended practice is to include a chick watering fountain along with the bait. Rats are much attracted to water and its inclusion will serve as a useful drawing card. Those that come to drink will stay to feed and are more likely to return to the same spot.

Figure 1. This well-constructed bait box is solidly built without a floor to encourage entrance of rats. It has two openings less than three inches in diameter on opposite ends of the station. *(Photograph courtesy U. S. Fish and Wildlife Service)*

Warfarin lends itself nicely to this type of program as it can be used in a cereal bait of a semi-permanent nature (Figure 2).

Figure 2. Warfarin corn meal bait should be placed in low metal containers. Losses caused by rats digging out the bait material and subsequent wastage can be minimized by the placement of a piece of one-half inch mesh screening on top of the bait and in direct contact with it.
(Photograph courtesy U. S. Fish and Wildlife Service)

The amount necessary for each station is dependent upon the frequency of servicing to replenish the bait supply. At the beginning it may be necessary to service the stations daily. Rats will consume large quantities initially and if the supply is exhausted the animals can recover completely. After most of the initial population has been eliminated, servicing the bait stations can be done at less frequent intervals. Present evidence seems to indicate that the bait should be replaced about every 2 weeks.

CONTROL WITHIN THE PLANT

The final line of defense is the plant itself. Loading docks are notorious rat havens. These should be screened or, better yet, filled with cement, because from these low harborages rodents take advantage of the never-failing opportunity to get in through a door or window. Openings at grade level should be adequately screened. While one-half inch mesh is sufficient to exclude rats, a mesh of one-quarter inch is necessary to keep mice out. More detailed instructions on methods of rat- and mouse-proofing can be obtained from your district representative of the U. S. Fish and Wildlife Service. Suffice to say that the cost of proofing in many cases pays for itself.

Inside the plant the fight must be continued. You have long been exposed to tirades on the application of proper sanitation practices. To these appeals one must say "Amen!" Good sanitation and rat control go hand in hand. It is almost impossible to maintain a high rat population in a place that is kept clean. With adequate facilities for disposal of refuse, removal of all rat and mouse harborage, and proper storage of supplies, plus perimeter control, rat and mouse infestations can be eliminated.

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Comparison of Frozen and Dehydrofrozen Peas With Fresh and Stored Pod Peas

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(Manuscript received May 12, 1952)

Frozen and dehydrofrozen peas processed in the laboratory were equal in quality to strictly fresh pod peas, except for small losses of sugar and ascorbic acid. No important chemical changes, other than changes in chlorophyll occurred in pod peas during 18 days' storage at 33° F. (.056° C.), but at 75° F. (23.9° C.) rapid losses of sugar and ascorbic acid occurred. Pod peas stored 6 or 7 days at 33° F. (.056° C.) were at least as good in eating quality as those stored 1 day at 75° F. (23.9° C.). Color changes in the pod peas occurred at about the same rate at the two temperatures during the first two or three days, but more rapidly thereafter at 75° F. (23.9°C.). These conclusions are based on objective analysis and subjective appraisal of frozen and dehydrofrozen peas stored briefly and pod peas stored up to 18 days at 33° F. (.056° C.) and up to 7 days at 75° F. (23.9° C.). The analyses included total solids, total sugars, reduced ascorbic acid, thiamin, chlorophyll, pH, and color as measured by reflectance.

The purpose of this investigation was to compare quality of frozen and dehydrofrozen peas with strictly fresh pod peas, and with pod peas stored under conditions simulating normal market practice. When growing areas are near retail markets, distribution of pod peas through the ordinary wholesale and retail channels requires a minimum of 24 hours and is more likely to be 3 or more days. Under these conditions the peas are usually held at ambient temperatures for a considerable part if not all of the time. When the peas are sold in distant markets, they may be iced during all or part of the holding time and shipped in refrigerated cars. In either case there is usually several days' delay after picking before the peas are consumed.

Progressive deterioration is known to occur during pod storage at ambient and refrigerator temperatures. Deterioration also occurs during processing under the best of conditions, due to leaching of soluble constituents.

The data obtained show the periods, following picking, in which pod peas are equal to, or better or poorer than, well-handled processed peas, and in what respects the peas differ at a given holding time. The study has also produced information on rate of deterioration of pod peas, since many experiments conducted at this Laboratory require that pod peas be held in refrigerated storage for as long as one or two days.

Pod peas were stored up to 18 days at 33° F. (.056° C.) and up to 7 days at 75° F. (23.9° C.). Frozen and dehydrofrozen peas *(21)* were prepared from harvest-day peas of the same lot. Criteria of quality were total solids and sugars, reduced ascorbic acid and thiamin content, chlorophyll degradation, pH, color as measured by reflectance, and judges' scores.

Most of the data were obtained in 1946 and 1947. Trends for the 2 years were the same for all factors measured, and actual levels of values differed only

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slightly; hence, the 1946 data are not reported. Some experiments were repeated in 1949 in order to obtain a better evaluation of the small changes that occurred in pod peas during the early storage periods.

RAW MATERIAL AND PROCESSING PROCEDURES

Raw material. Morses' No. 9 peas, an improved Laxton Progress variety, were used. They were grown under conditions for fresh market peas on non-irrigated land near Half Moon Bay in the California coastal area. This variety is suitable for freezing preservation as well as the fresh market.

In 1947 one harvest lot of 1,000 pounds of hand-picked peas was used for all measurements. The pod peas to be stored at 33° F. (.056° C.) and those for processing were heavily iced at the field, while those to be stored at 75° F. (23.9° C.) remained at ambient temperatures until they reached the laboratory. The time from beginning of picking until these reached the laboratory was 3 hours.

Processing procedures. Immediately on arrival at the laboratory, the peas allocated to processing were mechanically shelled, cleaned, and sized; sizes 3 to 6 were retained for the experiment. Following sizing, the peas were steam blanched for 38 seconds at 212° F. (100° C.). Blanching was slightly more than adequate as determined by the Masure and Campbell peroxidase test *(15)*. Following blanching, the peas used for freezing preservation were fog cooled for 1 minute, frozen on trays in circulating air at —10° F. (—23.3° C.), mixed, packaged in number 2 sanitary-type cans, and stored at —10° F. (—23.3° C.) for the 18 days involved in the experiment.

Following blanching, the peas to be dehydrofrozen were dehydrated in a cabinet dryer to 50% of their original weight. Dry-bulb temperature of the dryer was 160° F. (71.1° C.) and wet bulb temperature, 100° F. (37.8° C.). Drying time was 28 minutes. Except for the dehydration step, the dehydrofrozen peas were handled like frozen peas. For details of the dehydrofreezing process see Talburt and Legault *(21)*.

Pod storage procedure. Pod peas for storage studies were transferred to field boxes and put into controlled temperature rooms as soon as they reached the laboratory. After the planned days of storage, all peas of each temperature for one day's tests were mechanically shelled, sized, mixed, and divided with sampling funnels into suitable lots for assay. On harvest day, assays were started as soon as the processed material was frozen, namely, 6 hours after picking, and on all days assays were started within an hour after shelling.

1949 Peas. In 1949 four lots of pod peas, harvested at weekly intervals, were used as replicates. They were the same variety and from the same growing area as the 1947 peas. Selection during hand picking provided 4 lots of approximately the same maturity. The only storage conditions in 1949 were 0, 1, 2, 3, and 6 days at 33° F. (.056° C.) and 1 and 2 days at 75° F. (23.9° C.). All lots were frozen on the terminal storage day by the 1947 procedures with the following modifications: only sizes 3 to 5 were used; blanching was for 60 seconds at 212° F. (100° C.); storage was at —30° F. (—34.4° C.).

COOKING PROCEDURES

The optimum cooking period for each lot of peas was determined by judges. It would be of interest to have data for constant as well as optimum cooking periods but time necessitated a choice. Varying periods were desirable because texture of the lots differed.

A cooking lot for all samples except dehydrofrozen peas consisted of 300 g. of peas and 150 ml. of water; the fresh or solidly frozen peas were placed in boiling water. For dehydrofrozen peas, 150 g. of peas and 300 ml. of water were used, and solidly frozen peas were placed in cold water and brought to boiling in order to allow a few extra minutes for rehydration. The processed peas were boiled for 6 minutes; pod peas stored up to 1 day at either temperature were boiled for 8 minutes; those stored 2 days, for 9 minutes; up to 7 days, for 10 minutes; and up to 18 days, for 11 minutes. After cooking, the peas to be used for chemical analyses were drained for 1 minute on Buchner funnels with suction, and those for judging were drained on a screen sieve.

In 1947 when dehydrofrozen peas were included in the trial, the distilled water for cooking all samples was adjusted with sodium bicarbonate (0.03%) to pH 8.0. It will be shown later that this adjustment did not influence ascorbic acid or thiamin values. In 1949, when dehydrofrozen samples were omitted, our usual procedure of boiling the water for 5 minutes just prior to entering peas was used. The purpose of boiling was to remove carbon dioxide. The pH of water used in cooking is important because of its influence on color of peas.

ANALYTICAL PROCEDURES

Because of composition changes in peas due to respiration and leaching, all chemical data are reported on the per-pea basis. The count was made on 400-g. samples from each processing or pod-storage lot (only 200 g. for dehydrofrozen peas). Whenever assays were made on cooked product, the entire 300-g. cooking lot of peas or its total liquor was used. Uncooked pea samples were 300 g. except for total solids, for which 400 g. was used. All determinations were made in duplicate.

Total solids content of uncooked peas was determined by drying *in vacuo* to 2 or 3 percent moisture content, grinding in a mill to pass a 40-mesh screen, and drying an aliquot again *in vacuo* for 40 hours at 158° F. (70° C.). Total sugars of uncooked peas and liquor from cooked peas was determined by the Hassid *(6)* method. Sugar content of cooked peas was determined by difference. Reduced ascorbic acid content of uncooked peas, cooked peas, and liquor was determined by the Loeffler and Ponting *(13)* method modified by use of concentrated acid and ice in the first blending to avoid loss of vitamin from the hot product. Thiamin content was determined on selected samples only, and assays on uncooked and cooked peas and liquor were made. Weighed samples were blended with 0.04 *N* sulfuric acid immediately after preparation, then stored in tight containers at —20° F. (—28.9° C.) and analyzed later by the Conner and Straub *(2)* method with minor modifications. Color was measured with the Hunter reflectometer *(4)*. The pH of cooking liquors was determined with a standard pH meter, and the chlorophyll changes were measured spectrophotometrically *(3)*.

JUDGING PROCEDURES

The cooked peas were scored by 10 to 14 trained, selected judges. In 1947 all factors were considered together and rated as "general quality." Scores of 4 to 1 indicated excellent to poor quality, respectively. Each lot of peas was scored on terminal storage day; each pair was scored only once, and scores were analyzed by the paired t-test. Color was scored by a different panel in order to be able to make all measurements related to color on the same sample.

The scoring procedure used in 1949 differed markedly from that of 1947. Color, flavor, off-flavor, cotyledon and skin texture were scored separately. Score 7 indicated bright green color, pronounced characteristic pea flavor, no off-flavor, no graininess of cotyledons, and very tender skins. Score 1 indicated grayed or yellow green color, weak pea flavor, much off-flavor, very grainy cotyledons, and very tough skins. A labeled standard, prepared from pods stored 1 day at 33° F. (0.56° C.) with an arbitrary score of 5 for each factor, was submitted each taste session in an attempt to stabilize scores, but its score was not used in interpreting the data. Samples submitted in one taste session were from one harvest lot. Each judge's average scores for the 4 harvest lots were used in the analysis of variance, error being segregated into treatment, judges, and remainder. Judges' data are presented in the graphs as differences from the score for the coded harvest-day sample. It should be mentioned in considering the results presented below that statistically significant differences are not necessarily commercially significant. Statistically significant difference simply means that judges could distinguish between samples with reasonable certainty. The amount of deterioration that is important to consumers would have to be determined by a representative group of consumers.

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EATING QUALITY RESULTS AND DISCUSSION

1947 results. Figure 1 shows that the frozen peas were equal in eating quality to the strictly fresh pod peas and dehydrofrozen peas, within experimental error, and they were better than pod peas stored 2 days at 33° F. (.056° C.) or 1 day at 75° F. (23.9° C.). There was a clear trend showing progressive deterioration of pod peas with storage time at both temperatures. Although scoring procedure did not permit exact comparison of scores obtained on different days, the data indicate that 1 day at 75° F. (23.9° C.), gave about the same amount of deterioration as 7 days at 33° F. (.056° C.) and 3 days at 75° F. (23.9° C.), gave about the same as 14 days at 33° F. (.056° C.).

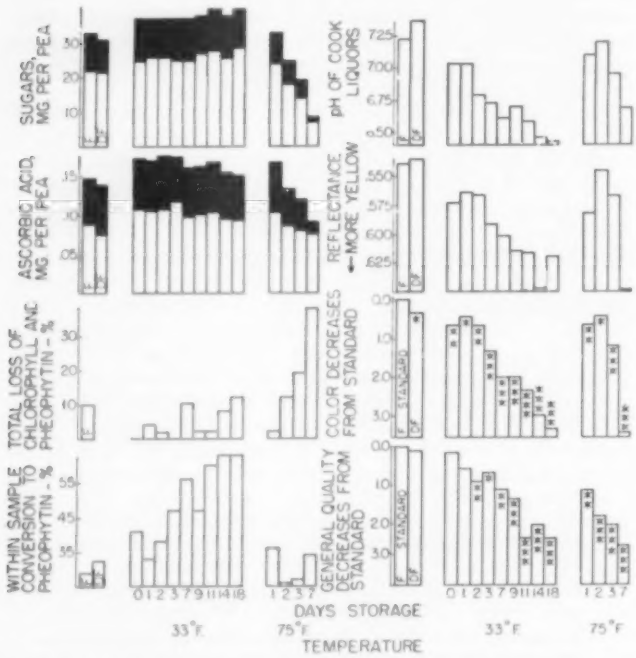

Figure 1. Comparison of frozen and dehydrofrozen peas processed on harvest day with pod peas from the same lot stored at 33° F. and 75° F. and cooked immediately after shelling. 1947 season.

F = frozen peas DF = dehydrofrozen peas
□ = cooked peas ■ = uncooked peas

***, **, *** = significantly different from standard at 5%, 1%, and 0.1%, respectively.**

1949 results. The 1949 judging results are summarized in Figure 2. Characteristic pea flavor scores are not reported because they followed off-flavor quite closely but, in general, showed smaller differences than off-flavor. With storage at 33° F. (.056° C.), color was the only factor that deteriorated significantly during the first day, but off-flavor had developed and skins toughened by the second day. There was a trend showing further deterioration in these factors with time, but differences were not statistically significant. Graininess of cotyledons was not observed until the sixth day at this temperature.

With storage at 75° F. (23.9° C.), scores for all factors decreased significantly after 1 day, and there were additional significant decreases in the two texture factors between the first and second days. The pod peas

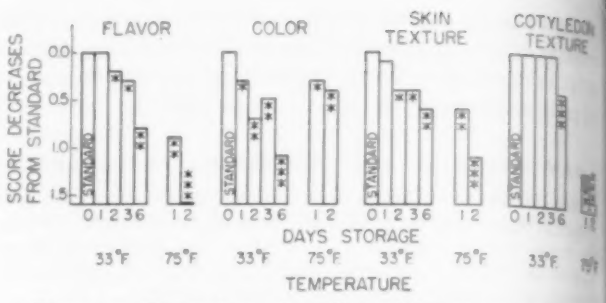

Figure 2. Comparison of quality of frozen peas stored in the pod for varying periods at 33° F. and 75° F. prior to freezing. 1949 season.

***, **, *** = significantly different from standard at 5%, 1%, and 0.1%, respectively.**

stored 6 days at 33° F. had about the same flavor, color, and skin texture, and better cotyledon texture than those stored 1 day at 75° F. (23.9° C.), and they were much better in all respects except color than those stored 2 days at 75° F. (23.9° C.). Color was about the same with equal storage time at the 2 temperatures.

Discussion of eating quality. The 1949 judging results are considered a more reliable evaluation of influence of short periods of pod pea storage than those of 1947 for several reasons: (a) day-to-day memory of quality was eliminated by freezing all samples and by scoring peas stored different periods side by side in one taste session; (b) the various quality factors were scored separately, and on a basis of characterization of qualities rather than desirability which might mean different things to different judges; (c) replication with 4 harvest lots was obtained.

The findings of this study show that processed peas, immediately after freezing, were as good in eating quality as strictly fresh peas, and other investigations of this laboratory show that they are quite stable when stored at —10° F. (—23.3° C.). Our most recent storage data on frozen peas *(12)* show that 3 lots of peas at prime maturity had not changed significantly after 1 year of storage at —10° F. (—23.3° C.). Two of these lots showed no observable change after 10.5 months at 0° F. (—17.8° C.), but one of them showed slight flavor deterioration after 7 months at this temperature. In another investigation *(21)* frozen and dehydrofrozen peas (50% moisture reduction) from the same lot, both stored for 1 year at —10° F. (—23.3° F.), were compared. Judges could not distinguish between them.

Although frozen peas can be handled and stored in such a manner that after 1 year they are equal in eating quality to strictly fresh peas, this is not necessarily the case with all commercial samples. In many instances it may not be practicable for processors to use the conditions of this experiment, especially as regards delay from field to package, and storage of the frozen material.

In addition to the information on the comparative quality of processed and pod peas, several other applications of a practical nature may be made from this investigation. The findings provide a strong argument for holding fresh market peas under cool conditions. The data could be used also as a guide to storage conditions prior to processing, both under commercial conditions if a mechanical pod picker becomes feasible *(22)*

and for laboratory experiments. Our evidence leads us to believe that there is little change in eating quality in 1 day of storage at 33° F. (—.056° C.).

RESULTS FROM CHEMICAL ANALYSES

The chemical data in instances where considerable change occurred are reported in Figure 1. The figure and all discussion are on the per-pea basis. The data for harvest-day peas calculated on fresh-weight basis are listed below, however, for the reader who has use for this supplementary information.

Constituent	Quantity per 100 g. of fresh peas
Total sugars	7.4 g.
Reduced ascorbic acid	34.0 mg.
Thiamin chloride	137.0 μg.
Total solids	18.7 g.

Sugars. The peas lost 11 and 16% of their total sugars during the freezing and dehydrofreezing procedures, respectively. The pod peas stored at 33° F. (.056° C.) increased slightly in sugars during the 18 days. Other investigators *(1, 20)* have reported increase due to transfer of sugars from pods to peas. At 75° F. (23.9° C.) the pod peas lost sugar rapidly: 11, 32, 50, and 80% in 1, 2, 3, and 7 days, respectively. Several investigators *(1, 8, 9, 18)* have reported similar but, in general, larger changes in sugar content during pod storage in the range of these temperatures. Losses of sugar to the liquor during cooking were about 30%, for all lots except the starchy, low-sugar-content peas stored 7 days at 75° F. (23.9° C.), for which the loss was 12%.

Ascorbic acid. Frozen and dehydrofrozen peas lost 15 and 20% of their reduced ascorbic acid respectively during processing. The pod peas lost small amounts of this vitamin during storage at 33° F. (.056° C.), 13% in 18 days, but at 75° F. (23.9° C.) they lost 22% in 2 days and 50% in 7 days. Several investigators *(10, 14, 17, 19, 23)* have reported similar losses during pod storage. Most of the pod lots lost about 37% of this vitamin to the liquor during cooking, while the frozen and dehydrofrozen peas lost 41 and 46%, respectively, and the pod peas stored 7 days at 75° F. (23.9° C.), 20%. In no instance was there significant destruction of the vitamin during cooking.

Thiamin. The thiamin values were determined for selected storage periods only, since the longest periods showed no significant change. Also processing caused no significant loss. The original content was very low, 137 μg. per 100 g. of fresh peas, which seems to be typical of the variety *(5, 16)*. Cooking losses to the liquor, as with sugar and ascorbic acid, were high, amounting to about 20%; there was no significant destruction of thiamin during cooking.

Total solids. The harvest-day, uncooked peas contained 96 mg. total solids per pea (not included in the graph), and they lost 7% of their solids during freezing and 9% during dehydrofreezing. All of the stored pods except the lot stored 7 days at 75° F. (23.9° C.) had similar solids content, 96 to 102 mg. per pea. The latter increased from 102 to 132 mg. per pea between the third and seventh days at 75° F. Total solids content of cooked peas was not determined.

Influence of sodium bicarbonate in cooking water. Because the sodium bicarbonate added to the cooking water might influence ascorbic acid and thiamin content of the cooked peas, this phase of the procedure was investigated. In one test, duplicate lots of peas were cooked in unadjusted distilled water, pH 5.9, and in distilled water adjusted as in the main study to pH 8.0 (0.03 percent sodium bicarbonate). In another trial, a larger range of concentrations of the bicarbonate was used, 0.03, 0.06, 0.12, and 0.24 percents. None of these solutions significantly influenced rduced ascorbic acid or thiamin content of cooked peas or cooking liquors. Hewston et al. *(7)* have reported similar results.

COLOR AND RELATED RESULTS

Chlorophyll changes. Chlorophyll data for uncooked peas are not reported, because no significant degradation was observed in any of the samples. However, other changes occurred during storage of the pod peas, which led to progressive chlorophyll changes observed in the cooked samples. Figure 1 shows the percent total loss of chlorophyll and pheophytin of each cooked sample compared with the cooked fresh peas of harvest day. The figure also shows the conversion (percent) of chlorophyll to pheophytin in a given cooked sample. In the case of samples stored at 33° F. (.056° C.) for 18 days, considerably more than one-half of the chlorophyll was converted to pheophytin (after cooking) with little change in the sum of these two components. In the 75° F. (23.9° C.) samples, different results were obtained. The percent of conversion of chlorophyll to pheophytin remained almost constant but there were progressive losses of chlorophyll and/or pheophytin amounting to about 40% during the 7 days of storage at this temperature. The frozen peas lost a small amount of chlorophyll, a relatively small proportion of which was converted to pheophytin. Data on losses of chlorophyll and pheophytin from dehydrofrozen peas are not given, since complete extraction of these pigments was not obtained with the procedure used. Complete extraction of pigments is not necessary, however, for reliable estimation of degradation of chlorophyll to pheophytin and the latter data show that the percent conversion was similar to that for frozen peas.

pH changes. The pH of cooking liquors decreased (because more acid) with increase in storage time, and decreased more rapidly at 33° F. (.056° C.) than at 75° F. (23.9° C.) (Figure 1). Liquors from the processed peas were less acid than those for strictly fresh peas.

Reflectance changes. Since Eastmond *(4)* has reported the details of the reflectance data, conclusions only are given here. Yellowness of pod peas increased with storage time. There was little difference between the lots stored at the two temperatures during the first 3 days, but when both lots were stored for 7 days, the 75° F. (23.9° C.) peas were considerably more yellow than the 33° F. (.056° C.) lot. The latter continued to change slowly with additional storage time. Both lots of processed peas were less yellow than strictly fresh peas. Directional luminous reflectance (not included in graph) showed that increasing lightness tended to follow increasing yellowness.

Association of objective data and judges' scores. The relationship of the objective measurements to judges' color scores follow:

	Reflectance Yellowness	Luminance	pH
Correlation coefficient—objective values with scores	—0.94	—0.80	0.88
Standard error of estimating score from objective value	0.38	0.65	0.51

Yellowness was the best objective measurement of color change as regards degree of association with judges' color scores and error of estimating score from

the objective value. Association of chlorophyll data with scores was not calculated, because obviously neither total loss of chlorophyll and pheophytin nor conversion of chlorophyll to pheophytin was closely associated for all samples. The total loss was closely associated with scores for the 75° F. but not the 33° F. (.056° C.) peas, and conversion was closely associated for the 33° F. (.056° C.) but not the 75° F. (23.9° C.) peas. Although chlorophyll data did not provide an independent measurement, these and the pH data give some information about the nature of changes that produced the color changes observed by judges. The pH is closely associated with degradation except for the 75° F. (23.9° C.) peas, where other factors obscure the relationship; also it is closely associated with reflectance yellowness and color scores. Any further study of causes of deterioration of stored peas should attempt to explain the pH changes.

A question might be raised about the relationship of bicarbonate in cooking water in 1947 to color changes. It should be noted that color scores decreased at about the same rate in 1949, when bicarbonate was not added but the water was boiled to increase its pH.

SUMMARY

Quality changes in peas during pod storage up to 18 days at 33° F. (.056° C.) and up to 7 days at 75° F. (23.9° C.) and during freezing and dehydrofreezing of harvest day peas of the same lot are reported. Changes in total solids, total sugars, reduced ascorbic acid, thiamin, chlorophyll, pH of cook liquors, color as measured by reflectance, and judges' scores were measured.

1. *Processed Peas.* Processed peas were equal in eating quality to strictly fresh pod peas, and slightly better than those held 2 days at 33° F. (.056° C.) or 1 day at 75° F. (23.9° C.). Also, they were at least equal to strictly fresh peas in color and thiamin content. The losses of soluble constituents were 7 and 9% of total solids, 11 and 16% of total sugars, 15 and 20% of reduced ascorbic acid during freezing and dehydrofreezing respectively.
2. *Pod Storage at 33° F. (.056 C.).* Pod peas stored at 33° F. (.056° C.) deteriorated in eating quality slowly but progressively with time, the differences being statistically significant after 2 days. These pod peas changed little or none in solids, sugar, or thiamin, but lost about 12% of their ascorbic acid in 18 days.
3. *Pod Storage at 75° F. (23.9° C.).* These peas deteriorated in eating quality rapidly and progressively with time, the score difference being significant in 1 day. Thiamin content had not appreciably changed after 7 days. There was a 50% loss of sugar and 22% loss of ascorbic acid in 3 days, and in 7 days, an 80% loss of sugar and 50% loss of ascorbic acid. Solids increased markedly between the third and seventh days.
4. *Comparison of 33° F. (.056° C.)* and *75° F. (23.9° C.) Storage.* In general, pod peas stored 1 day at 75° F. (23.9° C.) were equal in eating quality to those stored 6 or 7 days at 33° F. (.056° C.) and 3 days at 75° F. (23.9° C.) were equal to 14 days at 33° F.
5. *Data Related to Color.* Yellowness (as measured by reflectance) and pH were excellent indices of color changes as observed by judges. Neither relative nor total chlorophyll and/or pheophytin were found to be closely associated with color scores for all samples.
6. *Cooking Losses.* Losses of soluble constituents to the cooking liquors were quite large, 39% of sugars, 37% of ascorbic acid, and 25% of thiamin for most samples. There was no significant destruction of the vitamins during cooking.

Acknowledgment

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Interior Quality and Functional Properties of Oiled and Thermostabilized Shell Eggs Before and After Commercial Storage[a,b,c]

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A study was made of the functional properties of oiled and thermostabilized eggs before and after commercial storage at 31° F. (—.56° C.) for 4, 6 and 8 months. Eggs were stabilized in oil at temperatures of 130° F., 134° F. and 136° F. (54.4° C., 56.6° C., 57.7° C.) for 16 minutes and 144° F. (62.2° C.) for 8 minutes. The egg white whipping and angel cake-making properties were affected adversely by thermostabilization but sponge cake, plain cakes and custard-making properties were not significantly altered either before or after storage.

The attractive possibility of reducing quality deterioration that occurs in marketing shell eggs has resulted in investigations of oiling and oiling plus heat to improve the keeping quality of eggs. The beneficial effects of thermostabilization, Funk *(5, 6)*, in maintaining the initial high quality of eggs during storage and indications that some of the functional properties are altered by this treatment led to a need for further studies of the functional properties of such eggs. This report concerns primarily the functional properties of eggs theromstabilized in oil at several different temperatures, but also furnishes information on the interior quality of these eggs. The results are compared with results on eggs oiled in the ordinary way.

In addition to Funk *(5, 6)*, who developed the thermostabilization process, other investigators have indicated that the process leads to higher albumen indexes and in some cases to higher candle grades. Bose and Stewart *(2)* indicated that a definite increase in albumen index was produced by heat treatment of 4-day-old eggs but not in 5-hours-old eggs. Most recently Goresline *(7)* reported data showing the magnitude of the increase in albumen index that occurs during the thermostabilization.

In reporting on the cooking properties of thermostabilized eggs, Funk *(5)* observed that these eggs were superior to untreated eggs in all tests made with the possible exception of volume of egg white foam when whipped. Later Funk *(6)* published data to confirm the observation that albumen of thermostabilized eggs required more time for whipping and had a lower foam volume. Romanoff and Romanoff *(13)* have reported a lowered beating volume of egg white from shell eggs heated to 140° F. (60° C.) which they attribute to a partial coagulation of albumen during processing. Goresline *(7)* noted a marked increase in whipping time to be necessary to obtain a foam with thermostabilized eggs of a value comparable to that obtained with untreated eggs.

An alteration in the whipping properties of albumen from thermostabilized shell eggs is consistent with the effect of mild heat on liquid egg white. Investigations by Payawal, *et al. (11)* showed that denaturation of liquid egg white occurred in the temperature range of 136° F. (57.7° C.) to 144° F. (62.2° C.) and is characterized by significant changes in appearance and viscosity. Slosberg, *et al. (15)* reported an impairment in both rate of beating and angel cake volume, if liquid albumen is heated above 138° F. (58.6° C.) momentarily and then cooled. Also, losses in leavening power were found to occur when egg white was heated at temperatures below 136° F. (57.7° C.) and held for a sufficient period of time. Wilkin and Winter *(18)* stated that pasteurization of egg white lengthened the beating time and decreased the stability of the foam, but gave no data. Later Clinger, *et al. (4)* reported that egg white pasteurized at 134° F. (56.6° C.) for 4 minutes produced satisfactory but not optimum quality cakes, if the beating speed and time were practically doubled during beating of meringue.

With respect to keeping quality Funk *(6)* reported both thermostabilized and untreated eggs held in storage at 30° F. (—1° C.) for 6 months came out of storage with approximately the same albumen condition as when stored. However, when these eggs were subsequently held at room temperature, the thermostabilized eggs maintained their albumen height and scored remarkably well, whereas the natural eggs declined quite rapidly. Further when soiled eggs contaminated by washing were thermostabilized, sour eggs were eliminated and green white materially reduced. Goresline *(7)* reported that the percent of thick white was greater in stabilized eggs than in "natural" or "oiled" eggs after 4, 6 and 8 months of storage and that the albumen index remained higher during all storage periods for the stabilized eggs.

The study to be reported here was undertaken to determine more accurately the effect of thermostabilization on whipping and angel cake properties of egg white and to determine whether any other functional properties (whole egg sponge cakes, yolk sponge cakes, plain cakes and custards) of eggs are altered by thermostabilization either before or after storage. In addition and for correlative purposes information on the interior quality before and after storage has been gathered in terms of air cell width, albumen index, and yolk index. Other observations concern yield of egg meat, gross appearance, and ease of separation of the white and yolk.

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[b] This is a report of work done under contract between Iowa State College and the U. S. Department of Agriculture, as authorized by the Research and Marketing Act. The work was sponsored by the Bureau of Agricultural and Industrial Chemistry.

[c] Presented before the Twelfth Annual Meeting of the IFT, Grand Rapids, Michigan, June 11, 1952.

EXPERIMENTAL PROCEDURE

Source of eggs and method of processing. All eggs tested in this study were shipped from Kansas City, Missouri. Grade A eggs were procured, treated and stored in Kansas City under the supervision of Dr. Harry E. Goresline.[4] A description of eggs and treatments used have been reported by Goresline *(8)*. Certain cases of eggs were untreated to act as fresh controls for the tests made a few days after processing. Other cases of eggs were dipped in oil at 100° F. (37.8° C.) and 180° F. (82.2° C.) for 30 seconds to be used as oiled controls. The remaining cases of eggs were passed through the machine for thermostabilization and then placed on a moving belt with a fan blowing over the eggs. The length of time required to move the eggs up to the point of packing was 20 minutes.

The custom-made machine used for the thermostabilization was similar to that described by Goresline *(8)*. A thin film of heated oil flowed over the eggs; thus both thermostabilization and oil treatment were accomplished in one operation. Temperature of the oil was controlled within 2° F. (1° C.) and the same odorless, colorless, tasteless mineral oil was used in the thermostabilization process as was used for oil dipping at 100° F. (37.8° C.).

Treatment	Time	Oil Viscosity
1. Untreated Control	.....	.....
2. Oiled Controls 100° F. (37.8° C.)	30 seconds	50
3. Oiled Controls 180° F. (82.2° C.)	30 seconds	100
4. Oiled 130° F. (54.4° C.)	16 minutes	50
5. Oiled 134° F. (56.6° C.)	16 minutes	50
6. Oiled 136° F. (57.7° C.)	16 minutes	50
7. Oiled 144° F. (62.2° C.)	8 minutes	50

There were 9 dozen eggs in each of the treatments.

After the processing was completed in May 1950, 63 dozen Grade A eggs were shipped to the Iowa State College laboratory, Ames, for tests to determine the effect of oiling and thermostabilization on Grade A fresh eggs.

Approximately 200 dozen Grade A oiled and thermostabilized eggs were placed in cold storage at 31° F. (—.56° C.) at Empire Cold Storage Company, Kansas City, Missouri. Untreated eggs were not included in the storage study. At the end of 4, 6 and 8 months 54 dozen eggs were removed from storage, graded and shipped by railway express to the laboratory at Iowa State College for tests to determine the effect of storage on oiled and thermostabilized eggs.

This report includes the data obtained on the eggs sent to the laboratory and tested a few days after processing and the results of tests made on oiled and thermostabilized eggs stored at 31° F. (—.56° C.) for 4, 6 and 8 months.

Internal quality. To determine the initial quality of eggs used in the baked products, the following measurements were taken on each egg: a, weight, b, air cell width, c, albumen height, d, yolk width and e, yolk height. Albumen and yolk indexes were computed, as described by Wilhelm and Heiman *(17)* and Sharp and Powell *(14)*.

Liquid egg yield. Liquid egg yield was measured to determine to what extent the heat treatment caused the egg white to adhere to the shell. The following measurements were obtained on each dozen of eggs: a, weight of egg white, b, weight of egg yolk and c, weight of egg shell plus adhering egg white.

Functional tests. Angel cakes, whole egg sponge cakes, yolk sponge cakes, plain cakes and custards were made from untreated (used only in tests made shortly after processing), oiled and thermostabilized eggs. The same mixer, a Hobart Kitchen Aid (Model K-4-B), was used to mix all the products. Beating time of the meringue was recorded for the angel cakes and sponge cakes and meringue and batter specific gravities were determined. The same size baking pan was used for the cakes (5.5 x 3.5 x 2.75 inches) and they were baked in a Despatch Rotary Oven (Model 150-R). Volumes of the cakes were measured by the seed displacement method of King, *et al. (10)*.

[4] Formerly, Poultry Branch, PMA, U. S. Department of Agriculture; now Stability Division, QM Food and Container Institute, Chicago.

Angel cakes. After yolks and whites were separated, all egg whites from one dozen eggs were blended in a Waring blendor for 50 seconds with the variable voltage transformer set at 40v. The blending procedure described by Carlin and Ayres *(3)* was used. Aliquot samples of 61 g. of egg white were used to make angel cakes. The formula and procedure for the angel cakes were similar to those by Slosberg, *et al. (15)* and Carlin and Ayres *(3)*. One hundred and ten grams of batter were weighed into an ungreased baking pan and baked at 345° F. (175° C.) for 25 minutes.

Sponge cakes. Two types of sponge cakes were used to test the foaming properties of whole egg and egg yolk. In the tests made shortly after processing both yolk sponge cakes and whole egg sponge cakes were made. In the experiments on the stored eggs only yolk sponge cakes were made.

The formula and procedure for the whole egg or single meringue sponge cake reported by Hanson, *et al. (9)* were used with a few slight modifications: whole egg, blended, 64 g.; sucrose, 44.7 g.; cake flour, 28.3 g.; salt, 0.3 g.; and cream of tartar, 0.3 g. The egg, salt, sugar and cream of tartar were combined and the temperature was brought to 73° F. (23° C.). The mixture was beaten at speed 10 in a mixer until the meringue reached the "soft peak" stage. The specific gravities obtained ranged from 0.20-0.22; whereas, Hanson *et al. (9)* used a specific gravity of 0.23-0.25 as an end point.

One hundred and ten grams of batter were weighed into an ungreased baking pan, and baked at 350° F. (176.6° C.) for 22 minutes.

To test the foaming properties of the yolks, sponge cakes were made using only the yolks of eggs. The formula for the yolk sponge cakes was an adaptation of one reported by Pyke and Johnson *(12)*: egg yolks, blended, 50 g.; sugar, 44.6 g.; distilled water, 23.5 ml.; salt, 0.33 g.; cream of tartar, 0.33 g.; and cake flour 33.3 g. The water, salt, cream of tartar and egg yolks were mixed and the temperature adjusted to 77° F. (25° C.). This mixture was beaten in a mixer at speed 10 for 30 seconds, then one-half of the sugar was added while the mixer continued beating. After the sugar had been added, the mixer was stopped and a rubber scraper was used to clean the sides of the bowl. Beating was continued until a "soft peak" meringue was formed. Sifted flour and sugar were incorporated in 3 equal portions, using 10 strokes of a French balloon whip each time. Then 110 g. of batter were weighed into an ungreased baking pan. Cakes were baked for 25 minutes at 350° F. (176.6° C.).

Plain cakes. The formula for the plain cakes was as follows:

Sugar	100.0 grams	Salt	1.3 grams
Shortening	33.3 grams	Cake flour	75.0 grams
Whole egg	32.0 grams	Baking Powder (double acting)	3.0 grams
Milk	81.0 grams		

The dry ingredients which had been sifted 3 times were placed in a mixing bowl. The shortening and 54 g. of milk were added and this mixture was beaten on a mixer for 1½ minutes at speed 4. Then the bowl was scraped, the egg and 27 g. of milk were added and the mixture beaten at speed 4 for 1½ minutes. Specific gravity of the batter was determined and recorded. Two hundred and twenty grams of batter were weighed into a baking pan.

Custards. Baked custards were prepared using a standard formula: whole egg, 48 g.; milk, 244 g.; and sugar, 25 g. These ingredients were thoroughly blended and 110 grams were weighed into each of 2 custard cups. Custards prepared from 3 different samples were baked at the same time. The position in the baking pan of custards made from the various samples was randomized each time. Since preliminary experiments had shown that in a baking pan containing 6 cups the custards baked at different rates, a thermometer was placed in each cup. The pan was placed in the oven, boiling water was added and the custards were baked at 360° F. (182.2° C.). Temperatures of custards were recorded every 5 minutes. When the internal temperature of the custard reached 185° F. (85° C.), it was removed from the oven. The samples were stored overnight in the refrigerator. Stiffness of the custard was tested by means

of a Precision Universal Penetrometer 3512. In this test the depth of penetration is inversely proportional to the stiffness.

RESULTS

Effect of Heat Treatment and Storage on the Interior Quality of Oiled and Thermostabilized Eggs

Albumen index. The effect of heat processing on albumen index given in Figure 1 shows the extent to which thermostabilization raises the initial index of the eggs used in this study. The results are similar to the results of previous workers *(2, 7)*. An analysis of

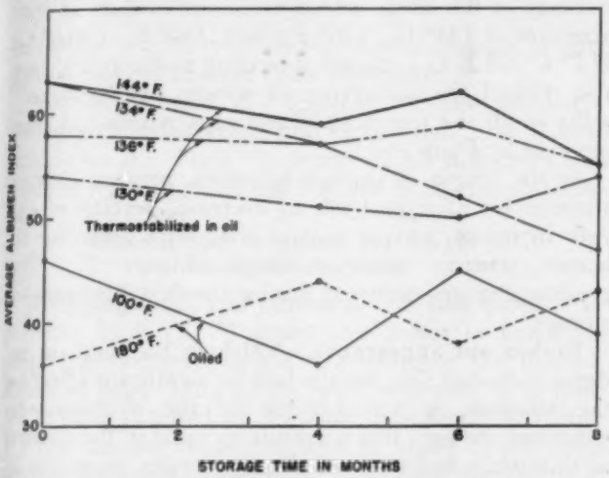

Figure 1. Effect of time and temperature of oiling eggs on the albumen index initially and following commercial storage at 31° F. for 4, 6 and 8 months.

variance of the data summarizd in Table 1 showed the increase in albumen index of the thermostabilized eggs was significant at the one percent level. A sub-division of the degrees of freedom for treatments shown in Table 1 revealed that the heat treatment caused a significant increase at the one percent level in the albumen index of thermostabilized eggs as compared to oiled eggs and a significant increase at the 5% level when eggs thermostabilized at 130° F. (54.4° C.) are compared to those stabilized at 144° F. (62.2° C.). However, the albumen indexes of eggs stabilized at 130° F. (54.4° C.) and 134° F. (56.6° C.) are not significantly different.

It is interesting to note in Table 1 that the treatment effect was independent of the storage periods. This would indicate that thermostabilization was not any more effective than oiling in stabilizing the albumen

TABLE 1

Analysis of variance of the albumen index for five treatments and four storage periods

Source of Variation	Degrees of Freedom	Mean Squares	F
Storage periods	3	795	1.47
Dates within storage periods	8	539	
Treatments	4	10,746	18.72[f]
Oiled vs. thermo.	1	38,820	67.63[f]
Oiled 100° vs. 180° F.	1	74	1.0
Thermo. 130° x 134° x 144° F.	1	3,488	6.08[*]
Thermo. 130° vs. 134° F.	1	601	1.05
Treatments x storage periods	12	614	1.07
Treat. x dates within storage periods	32	574	3.15[f]
Eggs treated alike	660	182	

[*] P = 5% level of significance.
[f] P = 1% level of significance.

index. The data of Funk *(6)* quoted in the introduction appear to corroborate results obtained when eggs were stored at 31° F. (—.56° C.). In the investigation being reported the effects of storage at room temperature were not studied.

Increase in viscosity of the albumen of thermostabilized eggs was obvious when these eggs were compared with the untreated and oiled controls. However, in the absence of untreated controls, one might not be aware of the difference in viscosity of eggs stabilized at the lower temperatures. In many of the eggs processed at 144° F. (62.2° C.) for 8 minutes there were gelatinous masses, a rough appearance, opalesence and/or increased turbidity which would be evident even to the casual observer (Figure 2). In some of the eggs, the albumen that was adjacent to the shell was quite opaque. Results obtained by Barott and McNally *(1)* indicated that the time interval for heat treatment at temperatures above 142° F. (62° C.) is extremely critical,

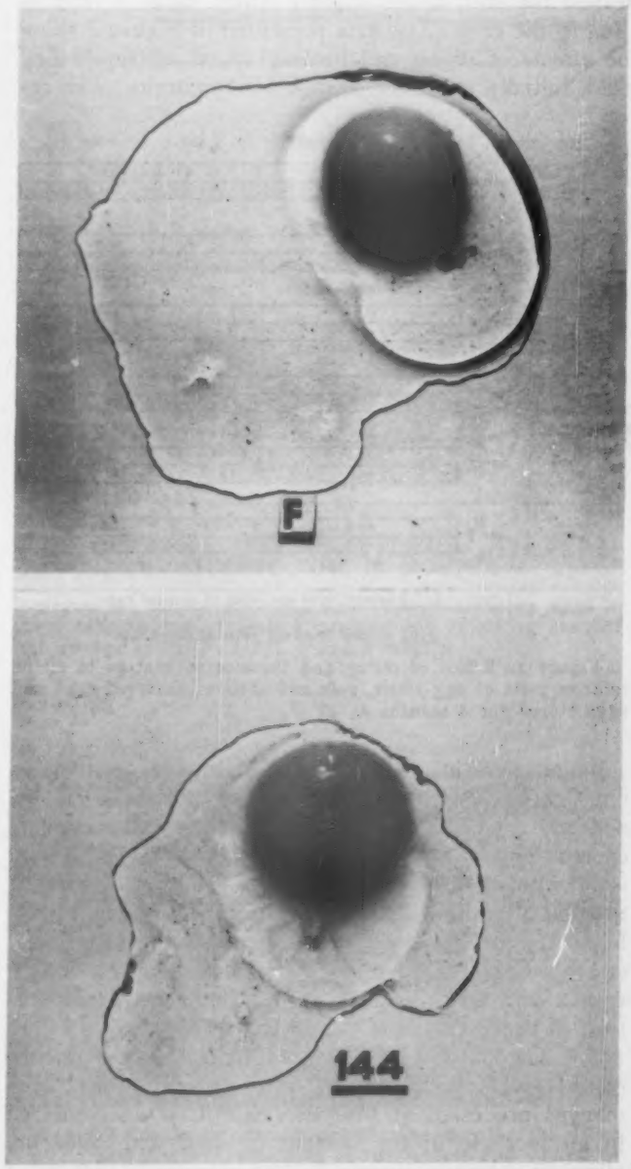

Figure 2. Raw untreated egg (F) and egg thermostabilized at 144° F. for 8 minutes (144). Notice gelatinous masses and rough appearance of albumen in 144 sample.

and they observed an increase in opacity in the albumen adjacent to the shell with a very slight increase in time of immersion. As previously found, Funk *(5)*, temperatures of 134° F. (56.6° C.) or above for the times used were not practical because of the resulting increase in opacity of the albumen. Since eggs treated for 16 minutes at 130° F. (54.4° C.) were the only samples entirely free of any visible evidences of coagulation, probably this temperature would be the best to use from this standpoint.

Thus, under the conditions of this experiment, thermostabilization exerts its beneficial effect on albumen index by raising the initial index of the eggs. During storage there were no significant changes in the albumen indexes of any of the eggs; at the end of the storage periods the thermostabilized eggs still have significantly higher albumen indexes than the oiled eggs.

Percent liquid egg yield. In all of the thermostabilized eggs, the heat treatment caused the albumen nearest the shell to gel slightly which made it tend to cling to the shell. The data presented in Figure 3 show the effects of oiling and heating in oil on liquid egg yield, initially and after storage for 8 months. The results on percent yield of egg white are particularly interesting. Yields of albumen for eggs oiled at 100° F. and 180° F. (37.8° C. and 82.2° C.) are rather similar except the yield for eggs processed at 180° F. (82.2° C.) is always slightly less. Although Funk *(5)* reported that heat treating eggs does not influence the yield of liquid egg, in this study yields of albumen from thermostabilized eggs were considerably lower than for oiled eggs with a noticeable decrease in yield as the temperature of processing was raised from 130° F. to 144° F. (54.4° C. to 62.2° C.). The great increase in the amount of egg white which could be seen to adhere to the shells of eggs processed at 144° F. (62.2° C.) was reflected in an increase in the percent of shell with adhering albumen shown in Figure 3. The increase in percent of yolk as the temperature of processing is increased may be the result of white which clung to the yolk or possibly, but less likely, it may be the result of water passing from white to yolk.

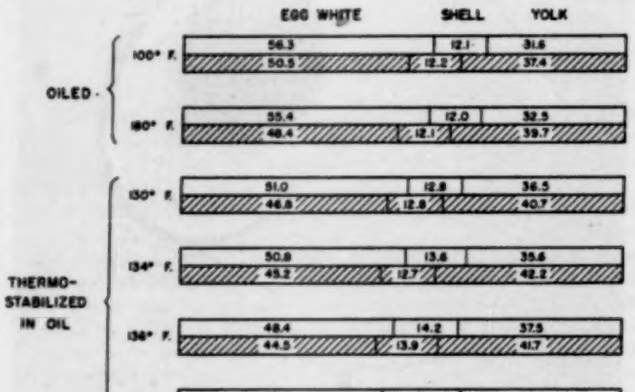

Figure 3. Effect of oiling and thermostabilization in oil on relative yield of egg white, yolk and shell of unstored eggs and eggs stored for 8 months at 31° F.

It seemed obvious to the workers who broke out the eggs that the consumer would have had to mechanically remove the adhering egg white from the thermostabilized eggs because it would not come out by the usual method of inverting the shell.

Although there are no supporting data, it was the observation of the workers who broke and separated the eggs that special caution was necessary to avoid breaking the yolks of thermostabilized eggs. Increase in viscosity of the white, which was more evident at temperatures of 134° F., 136° F., and 144° F. (56.6° C., 57.7° C., 62.2° C.), caused it to cling to the yolk. They also noticed the occurrence of watery or "ballooned" yolks in all the thermostabilized eggs which had been reported by Funk *(6)*.

As the length of storage increases, percent yield of albumen for all eggs tends to decrease, percent of egg yolk increases, and percent of shell with adhering albumen remains rather constant (Figure 3). The greatest changes occurred during the first 4 months of storage.

Broken out appearance. Although the data on indexes indicated that storage had no significant effect on the albumen, it was noticed by the workers who examined the eggs that a definite increase in the amount of thin white had occurred during storage, especially in the eggs oiled at 100° F. (37.8° C.). The thermostabilized eggs usually had a larger amount of thick white and maintained "stand up" fresh appearance, whereas, the eggs oiled at 100° F. (37.8° C.) had a small amount of thick white and most of the egg white was thin and spread out over a large area. The eggs oiled at 180° F. (82.2° C.) tended to be better than those oiled at 100° F. (37.8° C.), but they were not as fresh-appearing as thermostabilized eggs. The differences in the various treatments can be clearly seen in Figure 4, where typical examples of the treatments are shown.

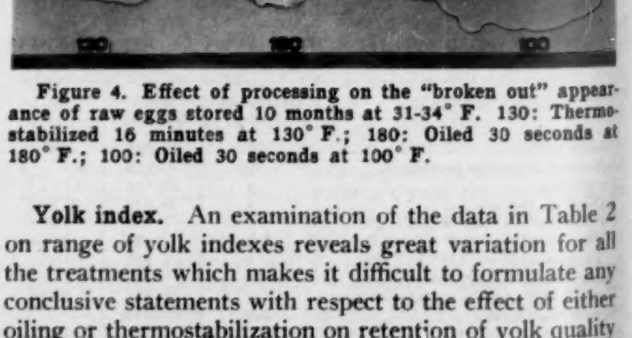

Figure 4. Effect of processing on the "broken out" appearance of raw eggs stored 10 months at 31-34° F. 130: Thermostabilized 16 minutes at 130° F.; 180: Oiled 30 seconds at 180° F.; 100: Oiled 30 seconds at 100° F.

Yolk index. An examination of the data in Table 2 on range of yolk indexes reveals great variation for all the treatments which makes it difficult to formulate any conclusive statements with respect to the effect of either oiling or thermostabilization on retention of yolk quality as indicated by yolk index. There were no significant

TABLE 2

Yolk index of oiled and thermostabilized U. S. Grade A eggs for 0 and 8 months of commercial storage at 31° F.

	100° F. 30 sec.	180° F. 30 sec.	130° F. 16 min.	134° F. 16 min.	136° F. 16 min.	144° F. 8 min.
No Storage						
Average[a]	.423	.418	.394	.420	.394[b]	.399
Range	.371-.487	.338-.478	.330-.462	.370-.488	.372-.440	.338-.454
Storage— 8 months						
Average[a]	.417	.417	.410	.400	.376	.397
Range	.354-.476	.355-.448	.346-.464	.320-.456	.342-.459	.330-.469

[a] Average of 36 eggs.
[b] Average of 24 eggs.

differences originally or after 8 months' storage, or after 4 and 6 months' storage (date unreported).

Bose and Stewart *(2)* reported "considerable variation in yolk index values; no explanation is at hand to account for it." Funk *(6)* found a high yolk index was retained by oil processing but not by thermostabilization.

Effect of Heat Treatment and Storage on Functional Properties

Whipping quality of albumen. As anticipated from previous work *(5, 7)* appreciable losses in functional properties occurred in the egg white of the thermostabilized eggs. Data on the angel cake-making properties of all eggs tested are presented graphically in Figure 5. The beating time required to reach a minimum specific gravity was longer in thermostabilized than in control eggs, and the specific gravity reached was not as low. This decreased beating power was reflected in a decrease in volume of angel cakes made with all the thermostabilized eggs. An analysis of variance of the data obtained in this study indicated that the decrease in angel cake volume in cakes made with thermostabilized eggs was significant at the one percent level. Volumes of all angel cakes made with stored oiled and thermostabilized eggs remained rather constant.

The cakes shown in Figure 6—which were made shortly after processing—illustrate the adverse effect of thermostabilization on the texture and volume of angel cakes (No. 4, 6, 7 and 8). Notice the similarity in texture and volume in the cakes made with fresh eggs and eggs oiled at 100° F. and 180° F. (37.8° C. and 82.2° C.). The data for the cakes in Figure 6 are as follows:

Cake No.	Treatment	Volume of Angel Cake ml. per 100 ml. batter
Top row		
1.	Fresh egg	622
2.	Oiled control, 100° F.	604
3.	Oiled control, 180° F.	624
4.	Thermostabilized 130° F.	531
Bottom row		
5.	Untreated control	618
6.	Thermostabilized 134° F.	537
7.	Thermostabilized 136° F.	524
8.	Thermostabilized 144° F.	496

Small angel cakes made with thermostabilized eggs have a lower volume that is constant throughout the storage periods, which indicates that the loss of whipping property due to heat denaturation of the albumen is not changed during storage.

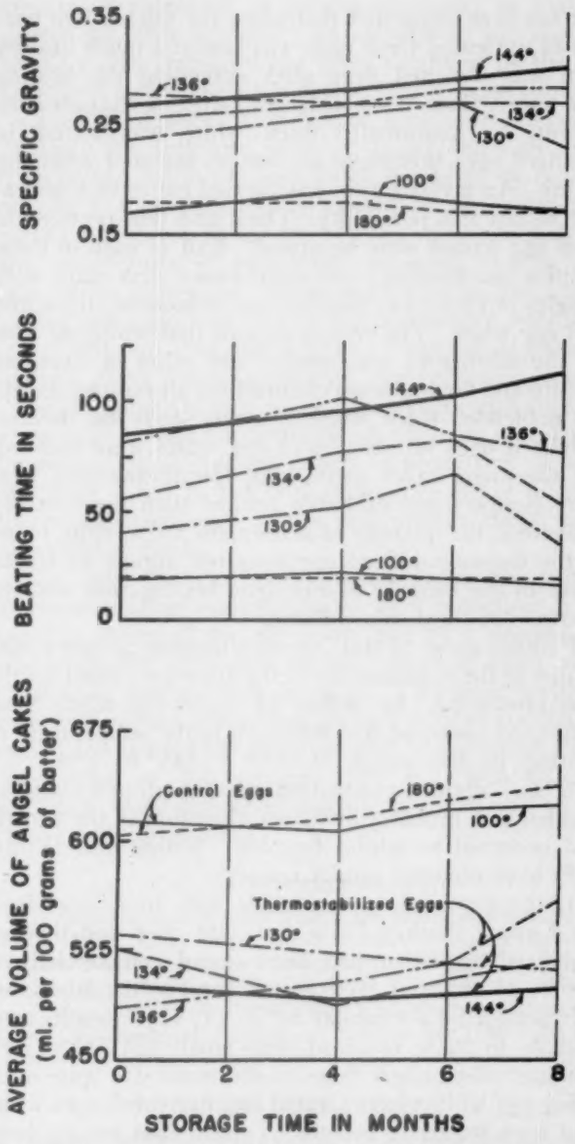

Figure 5. Effect of oiling and thermostabilizing eggs on angel cake-making properties initially and following commercial storage at 31° F. for 4, 6 and 8 months.

Figure 6. Cross sections of angel cakes showing the effect of oiling and thermostabilization in the texture and volume of angel cakes. 1: Fresh control; 2: Oiled, 100° F.; 3: Oiled, 180° F.; 4: Thermostabilized, 130° F.; 5: Untreated control; 6: Thermostabilized, 134° F.; 7: Thermostabilized, 136° F.; and 8: Thermostabilized, 144° F.

It has been suggested that when the thick white portion of untreated fresh eggs was beaten a much heavier foam was obtained even after extending the beating time more than three-fold, and since a considerable quantity of abnormally thick white was found in stabilized eggs, this might account for the poor whipping quality. An investigation was carried out in this laboratory to test this possibility. Thick and thin portions of fresh egg whites were separated. Half of each of these samples was blended; then angel cakes were made with samples of each—i.e., blended and unblended, thick and thin egg white. The results showed that whipping time for the meringues was similar and cakes of excellent texture and volume were obtained for all samples except the unblended thick white. In this study on thermostabilized eggs all samples of egg white were blended, but the angel cakes made with thermostabilized eggs were compact and of lower volume than the controls. Therefore, the quantity of abnormally thick white found in the thermostabilized egg does not appear to be the cause of the increase in meringue beating time and the decrease in angel cake volume.

Perhaps some of this loss of whipping property may be due to the denaturation of the albumen caused by the heat processing. In studies on liquid egg white Slosberg *(16)* observed that increases in the temperature of heating in the range of 130° F.-145° F. (54.4° C.-62.8° C.) decidedly impaired beating property and he decided that probably sufficient alteration in the protein had occurred to inhibit foaming. Wilkin and Winter *(18)* have reported similar results.

Large angel cakes were made with fresh eggs from the College Poultry Farm and with oiled and thermostabilized eggs that had been stored commercially at 31° F. (—.56° C.) for 8 months and in the laboratory refrigerator for 8 weeks at 34° F. (1° C.). Results comparable to those obtained with small test cakes were obtained when angel cakes of the usual size were made using egg whites from treated and untreated eggs which had been stored 10 months. Typical data for the large angel cakes are as follows:

Sample of egg	Beating time of meringue	Specific gravity of meringue	Ht. of cake
	Sec.		*cm.*
Fresh	56.7	.222	9.6
Oiled 100° F., 30 sec.*	65.2	.247	8.9
Oiled 180° F., 30 sec.*	86.3	.260	8.7
Thermo. 130° F., 16 min.*	143.1	.292	7.8

* Stored commercially for 8 months at 31° F. and 2 months in laboratory refrigerator at 34° F.

The cakes shown in profile in Figure 7 illustrate three points: a, the difference in volume which was typical of large angel cakes made with eggs oiled at 180° F. (82.2° C.) and thermostabilized at 130° F. (54.4° C.) and stored 10 months, b, cakes of good volume and texture were obtained using egg whites from oiled eggs stored 10 months and c, the whipping properties of oiled or thermostabilized eggs did not change during the storage times studied.

Whipping quality of whole egg. Thermostabilization in oil did not significantly affect either the beating time of the meringue or the texture and volume of the sponge cakes made from whole egg. The following summarizes the data obtained on whole egg sponge cakes:

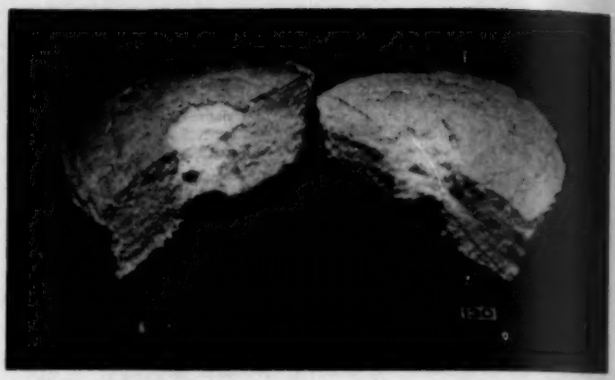

Figure 7. Effect of processing on the volume of large angel cakes made with egg white from eggs stored 10 months at 31-34° F. 180: Eggs oiled at 180° F. for 30 seconds; 130: Eggs thermostabilized at 130° F. for 16 minutes.

	Untreated control	Oiled		Thermostabilized			
		100° F. 30 sec.	180° F. 30 sec.	130° F. 16 min.	134° F. 16 min.	136° F. 16 min.	144° F. 8 min.
Volume in ml./100 g. batter	618	626	626	627	618	636	615

In all cases whether untreated, oiled or thermostabilized eggs were used, excellent sponge cakes were obtained. No whole egg sponge cakes were made at 4, 6 or 8 months of storage.

Whipping quality of yolk. Excellent sponge cakes were obtained from all eggs used at all storage periods. Thermostabilization or oiling had no significant effect on the beating time of the meringue or the texture and volume of the sponge cakes that were made from egg yolk at the various storage periods. The average volumes of cakes per 100 ml. of batter were: 100° F. (37.8° C.), 586 ml.; 180° F. (82.2° C.), 562 ml.; 130° F. (54.4° C.), 580 ml.; 134° F. (56.6° C.), 562 ml.; 136° F. (57.7° C.), 571 ml.; 144° F. (62.2° C.), 576 ml.

Plain cakes. Uniformity in volume and texture was obtained in the plain cakes whether oiled or thermostabilized eggs were used, and the cakes were very similar for all storage periods.

Custards. There was no variation in the performance of eggs in custards whether they were made from oiled or thermostabilized eggs. Storage of the eggs did not affect the stiffness of the custards in any case.

DISCUSSION

The effect of thermostabilization appears to be irreversible with respect to functional properties. Thus functional properties of the oiled control eggs and the eggs thermostabilized in oil did not change significantly with storage. This was true both for the properties that *were* and *were not* altered initially by thermostabilization.

The egg white whipping and angel cake making properties were affected adversely by thermostabiliza-

tion but the sponge cake, plain cake and custard making properties were not significantly altered. It is of interest that there was no carry-over of this damage when sponge cake tests were made with whole egg. This, is consistent, of course, with the knowledge that angel cake quality is a sensitive index of egg white properties, whereas sponge cake quality — which reflects yolk properties primarily—is not.

The interior quality characteristics of the thermostabilized eggs were affected in a manner similar to that reported by other workers. Although the albumen index did not change significantly during storage, the change in appearance of the eggs shows that some changes occur in the egg white during storage. Thus, it might appear that thermostabilization does not retard the rate of deterioration as evidenced by thinning of the thick white, but instead merely increases the amount of thick white and the albumen index initially. Better quality factors would then be evident after storage because these factors were higher initially rather than because their rate of loss was decreased by the treatment. For practical purposes the explanation is, of course, not so important as the desirability of the result.

Since this study was undertaken from a critical point of view, it might be noted that the following factors tend to make thermostabilized eggs undesirable: a, poor whipping and angel cake making properties of the white, b, lower yield of egg white (probably not a recognizable factor to the housewife), and c, decreased convenience with respect to the separation of yolk and white. The advantages of thermostabilized eggs are improved broken-out appearance after storage and, corollarily, improved candle grade after storage.

This study then would direct consumer preference studies of thermostabilized eggs to factors a, b and c in the foregoing, since presumably broken-out appearance will be largely eliminated as a factor by candling. If the eggs are used for table purposes, the most important information that might be obtained would be with respect to flavor and possibly texture differences. There appears to be no evidence in the literature that thermostabilization alters flavor or texture even to a minor degree.

If it is found that items a, b and c (stated above) do not cause marked objection by the consumer then the usefulness of thermostabilization of eggs for household use will depend on the extent to which it will reduce losses in candle grade and losses due to spoilage.

SUMMARY

The interior quality and functional properties of eggs thermostabilized in oil at 130° F., 134° F. and 136° F. (54.4° C., 56.6° C., and 57.7° C.) for 16 minutes and 144° F. (62.2° C.) for 8 minutes were compared a few days after processing with untreated eggs and eggs oiled at 100° F. (37.8° C.) and 180° F. (82.2° C.) for 30 seconds. Oiled and thermostabilized eggs were compared after commercial storage at 31° F. (—.56° C.) for 4, 6 and 8 months.

The interior quality of all eggs used in the functional tests was assessed by albumen index, yolk index and meat yield. The albumen indexes of thermostabilized eggs were increased to an extent similar to that reported by other workers. An increase in the viscosity of the thermostabilized egg white produced by the heat treatment tended to improve the "fresh" appearance or "stand up" quality. However, it was more difficult to separate the yolk and white of thermostabilized eggs. The higher initial albumen index exhibited by thermostabilized eggs (apparently caused by the heat treatment) was constant for the storage times studied. As the temperature of processing increased, the yield of egg white decreased. These eggs had higher candle grades and improved broken out appearance after storage. Although the oiled eggs had lower initial albumen indexes, there was no significant change during storage.

Angel cakes, sponge cakes, plain cakes and custards were made to test the performance of the eggs in baked products. No deleterious effects of processing or storage were noted in the performance of either oiled or thermostabilized eggs in the yolk sponge cakes, plain cakes and custards.

The only changes in functional properties due to thermostabilizing were evidenced by a reduction in the foaming ability of the egg white and by a decrease of approximately 10 to 20% in the volume of angel cakes made from thermostabilized eggs. This poor performance with respect to foaming properties does not change during storage for the times studied. Cakes made from eggs oiled at 100° F. and 180° F. (37.8° C. and 82.2° C.) were similar in texture and volume at the various storage periods.

Acknowledgment

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Yeasts Occurring in Citrus Products[a]

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(Manuscript received July 16, 1952)

Citrus juices are relatively unstable and unless prepared and handled carefully may undergo chemical, enzymatic or microbial deterioration. Commercial pasteurization as practiced in the citrus juice industry prior to the introduction of unpasteurized frozen citrus concentrates was sufficient to eliminate spoilage by microorganisms. The frozen concentrates, however, if made properly should never reach the pasteurization temperature during manufacture, storage, or preparation for use. Because of the high acid and sugar content of citrus concentrates, the organisms most apt to grow are yeasts and molds. There is, however, a sparsity of information concerning the taxonomy of organisms occurring in citrus products as well as the conditions under which they grow. The present investigation was undertaken with the view of obtaining information on these specific points as related to yeast.

REVIEW OF LITERATURE

The microbial contamination of the surface of fresh oranges before and after harvesting was studied by Aschner and Cukierman *(1)*. The microbial populations on harvested fruit was greater than those on unpicked fruits. Aschner isolated 4 cultures of yeasts, 2 of which were osmoduric and capable of growth in 65° Brix syrup; however, he did not identify them.

Braverman *(4)* indicated that there may be as many as 100 million microorganisms on the surface of an average orange but did not give the relative number of yeasts, molds and bacteria. Muller *(12)* mentioned *Nematospora* rot as an important citrus disease in the Dutch East Indies. Webber *(16, 17)* reported the occurrence of *N. coryli* in grapefruit and oranges in Florida. Fawcett and Klotz *(7)* observed the occurrence of *N. gossypii* in oranges growing near pomegranates in the Imperial Valley, California, and stated that the yeast was transmitted from the pomegranate to citrus by the puncture bug, *Leptoglossus zonatus*.

Brannon and Pollitt *(3)* isolated strongly fermentative yeasts from orange and grapefruit juices. Unfortunately, these organisms were not identified. Incidental to a study of the efficiency of "flash" pasteurization, Nolte and von Loesecke *(13)* isolated cultures of *Saccharomyces cerevisiae*, *S. ellipsoideus*, *S. pastorianus*, *S. apiculatus*, (probably *Hanseniaspora*), *Mycoderma cerevisiae* and a "pink torula" (probably *Rhodotorula*) from grapefruit juice.

During World War II, considerable citrus concentrate was shipped to England from the U. S. A. Some of this underwent spoilage as a result of yeast fermentation. While studying this spoilage, Ingram *(8)* isolated 2 organisms, one a "pink yeast" with the general properties of *Rhodotorula* and the other an "osmophilic species" of *Zygosaccharomyces* capable of growing in 65° Brix orange concentrate. In both cases growth was inhibited at temperatures below 40° F. (4.44° C.). Later, Ingram *(9)* indicated that the osmophilic cultures of *Zygosaccharomyces* were able to ferment orange juice at pH 3 containing 70% sugar. These organisms were able to ferment glucose, fructose and mannose but not sucrose.

The Research Department of the Continental Can Co. *(5)* found no evidence of yeast growth when a concentrated sugar medium was used for isolation. However, when an acidified dextrose medium was used, 4 species of yeasts were isolated but not identified. It was concluded that yeasts present in citrus concentrate may remain dormant until conditions become favorable for growth and hence subsequent spoilage.

It is apparent from the meagerness of literature concerned with yeasts in citrus products that an intensive taxonomic study of the yeasts involved is timely.

EXPERIMENTAL PROCEDURES

Isolation. Yeasts were collected in 3 citrus processing plants and one packing house, all located in Southern California. Isolations were made from fresh oranges, citrus products at various stages of processing, and fruit flies collected at the processing plant and a number of miscellaneous sources. (See Table 1). Fresh fruit samples were taken with large forceps from holding bins, belts and boxes, and transferred into sterile paper bags for conveying to the laboratory; they were then rinsed thoroughly in half gallon mason jar (approximate) containing 200 ml. of .01% Na_2SO_3 solution. This was done to neutralize the chlorine remaining on the fruit after washing at the processing plant. A loop of the rinse solution was then streaked on a wort agar plate (5% wort powder and 2½ agar). Characteristic colonies were picked and purified by 3 successive platings on wort agar. This procedure is used commonly in the industry for the purpose of determining the efficiency of washing prior to processing according to Beisel *(2)*.

Single strength juice was plated directly, but isolations from concentrate were made by plating on wort agar after diluting 1:10 (at Anaheim) or by plating on Lindegren's yeast agar after diluting 1:1000 (at Fullerton).

[a] Presented at the Twelfth Annual Meeting of the IFT, Grand Rapids, Mich., June, 1952.

TABLE 1
Number of cultures from various sources

Taxonomic Designation	Sources							
	Surface of Orange	Surface of Lemon	Orange Juice	Lemon Juice	Orange Conc.	Lemon Conc.	Drosophila	Miscellaneous
Candida krusei	2		3	2	3	2	1	
C. guilliermondii	1				2	1		1(a), 1(b)
C. parapsilosis	1			1	1	1		1(b)
C. melibiosi						4		
C. melinii						1		
C. tropicalis var lambica					1			
C. pulcherrima		1						
C. pelliculosa						1		
Zygosaccharomyces vini			4					
Z. major					1		1	
Z. fermentati		1					1	
Z. japonicus					2			
Z. priorianus			1					
Z. mandshuricus								1(c)
Z. mellis aceti						1		
Z. globiformis								
Hanseniaspora melligeri	5	1	4					
Pichia fermentans	6		1				1	
Pichia chodati var. fermentans	1						1	
Saccharomyces cerevisiae			1			1	1	
S. exiguus								1(d)
S. oviformis								1(c)
S. carlsbergensis var. mandshuricus				1				
S. elongasporus nov. sp.					3			
Klockera jensenii						3		
Klockera lindneri				1			1	
Rhodotorula glutinis							1	1(f)
Rhodotorula mucilaginosa						1		
Oospora lactis	2		1					
Trichosporon cutaneum	1							
Trichosporon fermentans			1					
Hansenula anomala	1							
Torulopis glabrata					1			
T. citrus nov. sp.						1		
Sporobolomyces odorus							1	
Pullularia pullulans	1							
Totals	20	3	17	5	14	17	9	7

(a) Isolated from conveyer leading from the holding bin. (b) Isolated from surface of grapefruit. (c) Isolated from orange beverage. (d) Isolated from brined orange peel. (e) Isolated from lemon beverage. (f) Isolated from rotted naval orange peel.

Fruit flies were collected by the method of Shihata *(14)* except that fermenting orange juice was used as bait. The flies were etherized, washed in a solution of "Roccal" (1000 p.p.m.), rinsed, and then squashed on a wort agar plate. After growth occurred, isolation and purification was pursued as indicated above.

A number of yeasts isolated by the research department of the California Fruit Growers Exchange from various sources in a citrus processing plant were also included in the study, because they represented organisms collected over a period of years.

Identification. With minor exceptions the procedures and schemes of Stelling-Dekker *(15)*, Lodder *(10)*, Diddens and Lodder *(6)*, and Wickerham *(18)*, were followed for taxonomic treatment. The presence of carotenoid pigments was determined by the procedure of Mrak, Phaff, and Mackinney *(11)* and pseudomycelium formation was considered in all cases.

Sugar tolerance. This was determined by inoculating and incubating orange juice samples (at pH 3.1) with sugar concentrations of 35, 45, 55, 65, or 75° Brix. Juices containing 35, 45, 55, 65 percent sugar (Brix degree) were prepared by diluting 66° Brix commercial concentrate with water. In order to obtain a sugar concentration of 75° Brix, sucrose was added to the 66° Brix concentrate. Concentrations were verified by use of an Abbe refractometer, following sterilization of the concentrate for 10 minutes at 212° F. (100° C.).

Since adaptation of the organisms was considered a possibility, yeasts growing in the 35° Brix concentrate were transferred to 45° Brix concentrate; those growing in the 45° Brix concentrate were transferred to a 55° Brix concentrate, etc. Growth was recorded positive if there was any indication of film formation, fermentation, or sedimentation. Cultures were observed periodically until growth was noted but not for over 30 days.

Growth at low pH. Since the isolates were obtained from acid products, only tolerances to the lower pH ranges were determined. In conducting these tests, acid was added to a glucose yeast autolysate medium until the desired pH was obtained.

The yeast autolysate was prepared by mixing one part of brewers yeast with one part water, and then incubating for 3 days at 131° F. (55° C.). Following this the autolysate was filtered through Super-Cel. One part of autolysate was mixed with nine parts of water and then 5% of glucose was added.

The pH values of the preparations used were 3.0, 2.5, 2.0 and 1.5 and 1.0. The solutions at pH 3.0 and 2.5 were prepared by adding citric acid until the desired pH was reached. Solutions at pH 2.0 and 1.5 and 1.0 were made first by lowering the pH value to 2.4 with citric acid and then adjusting further with 1 *N hydrochloric* acid. The solutions were sterilized for 10 minutes at 239.5° F. (115.5° C.) and then pH values of the sterilized solutions were found to be 2.90, 2.45, 1.94, 1.45, and 1.14. Growth was determined by fermentation, film formation and sedimentation. Periodic observations were made until growth was noted but not for longer than 21 days.

Growth at low temperatures. Heavy suspensions of yeast in sterile water were made for subsequent use in inoculating 10% wort agar slants. These inoculated slants were incubated at 57°, 50°, 47°, 41°, 37°, 32° F. (14°, 10°, 8.5°, 5.0°, 2.5°, or 0° C.) until growth was noted but for not over 21 days.

EXPERIMENTAL RESULTS

Ninety-two cultures were isolated from fruits, juices, concentrates and other sources in citrus processing plants located in Southern California. Eighty-seven of the cultures were isolated from 7 main sources and 6 from miscellaneous sources.

Most of the organisms were obtained from oranges *(20)*, single strength orange juice *(17)*, lemon concentrate *(17)*, and

orange concentrate *(14)*. Nine cultures were isolated from the intestinal tracts of fruit flies *(Drosophila sp.)* collected in processing plants, 5 from single strength lemon juice and 3 from lemons. Single cultures were obtained from a conveyor belt, grapefruit, brined orange peel, decayed orange peel and orange and lemon beverages. (See Table 1).

Taxonomy. Forty-nine of the cultures were considered as imperfect and forty-three as ascospore formers. The imperfect yeasts were represented largely by species of *Candida (33)* and to a lesser extent by *Kloeckera (5)*. The remaining 13 cultures of imperfects included representatives of *Oospora, Pullularia, Rhodotorula, Torulopsis, Trichosporon,* and *Sporobolomyces.*

Representatives of the ascospore forming yeasts on the other hand were quite evenly distributed among 4 genera as follows: *Zygosaccharomyces (14), Hanseniaspora (10), Pichia (9),* and *Saccharomyces (9)*. A single culture of *Hansenula* was also isolated.

From a taxonomic point of view the characteristics of the cultures identified were identical or, in a few cases, slightly different from those given by Stelling-Dekker *(15)*, Lodder *(10)* or Diddens and Lodder *(6)*. Four of the isolates differed markedly from any described species. These have been designated as 2 new species, namely: *Saccharomyces elongasporus* nov. sp. and *Torulopsis citrus* nov. sp.

Saccharomyces elongasporus Nov. Sp.[b]

Cells in liquid wort oval to ellipsoidal, single or in pairs. In 3-day culture: cell size (2.8-5) × (3.5-5.6)μ. On wort agar: cell size (2.8-6.3) × (2.8-7.7)μ. In liquid wort: formation of the thin ring and sediment. Ascospore formation: sparse on Garodkowa agar—usually one, occasionally 2 long oval ascospores (shorter and more rounded than in Nematospora), nearly filling the ascus. Fermentation of glucose and galactose (weak). Assimilation of glucose, galactose, sucrose and maltose but not lactose. Peptone, asparagine, $(NH_4)_2SO_4$ and urea (weak) utilized as sources of nitrogen; KNO_3 not utilized. A very thin gray film when on alcohol medium. Arbutin, not split; acid, not produced. Slant culture on wort agar: cream colored, smooth, slightly glossy, soft and broadly convex with border evolving into a pseudomycelium. Giant colony characteristics on Wickerham morphology medium: similar to those of slant culture.

Torulopsis citrus Nov. Sp.[c]

Cells oval in 3-day liquid wort, small, (1.4-2 × (2.8-4.2)μ. Size and shape in wort agar the same as in liquid. Characteristically grouped in clusters, but may occur single or in pairs. Ferments glucose, maltose and galactose (weak) but not sucrose, raffinose or lactose. Assimilation of glucose, galactose and maltose but not sucrose or lactose. Asparagine, $(NH_4)_2SO_4$, peptone and urea (weak) and KNO_3 utilized as sources of nitrogen. No growth in ethyl alcohol medium; arbutin, not split, no acid production.

Slant culture buff, smooth with very fine radiating contours, soft and broadly convex with an entire edge. Giant colony on Wickerham morphology agar creamy with buff center, smooth with fine radiating contours, soft and broadly convex with a lobed border.

Distribution. Twenty-four cultures representing 11 species were isolated from fresh oranges, lemons or grapefruit. Four of these, namely, *C. pulcherrima, Hansenula anomala, Tr. cutaneum* and *P. pullulans* were obtained only from fresh fruit. Two, *H. melligeri* and *O. lactis* were obtained from single strength juice as well as the fresh fruit. The others were isolated from a number of sources.

Twenty-four cultures were also obtained from single strength orange and lemon juice and beverages. These were represented by 12 species. Only *C. krusei, C. parapsilosis, H. melligeri, P. fermentans* and *O. lactis* were also isolated from fresh fruit. Other organisms obtained from the single strength juices were *Z. vini, Z. priorianus, Z. globiformis, S. cereviseae, S. carlsbergensis, K. lindneri* and *T. fermentans.*

Thirty-one cultures isolated from concentrates were represented by 16 species. Of these but 2 *(C. krusei* and *C. parapsilosis)* also were found on fresh fruit and in single strength juice. *S. cerevisiae* was found in juice but not on fresh fruit. Most of the organisms obtained from concentrates were species of *Candida. C. melibiosi, C. melinii, C. tropicalis* var. *lambica* and *C. pelliculosa* were obtained only from concentrates.

The 4 cultures of *Zygosaccharomyces* isolated from concentrates represented 3 species, *Z. major, Z. japonicus* and *Z. mellis aceti.* One culture of *S. cereviseae* was isolated from concentrate as well as juice and 3 of *S. elongasporus* nov. sp. only from concentrate. Other cultures isolated from concentrate were *K. jensenii, R. mucilaginosa* and *T. glabrata.*

Nine cultures were isolated from the intestinal tract of *Drosophila* flies trapped in or about processing plants. Six of the 9 species isolated were also found on citrus products which may very well have served as feeding places for the flies.

At the start of this study it was presumed that large numbers of *Nematospora* and *Hansenula* would be encountered. *Nematospora* frequently parasitizes citrus but the fruit and products surveyed apparently were free of it. Species of *Hansenula* are frequently found in food plants and on foods so it was presumed that they would be found in the products studied.

Sugar tolerance. All cultures of *Zygosaccharomyces* except *Z. globiformis* and *Z. mellis-aceti* grew well in the presence of 65% sugar. The growth of *Z. vini* and *Z. fermentans* was much slower and more sparse than that of the others. The following grew slowly in 65° Brix medium: 3 cultures of *C. guilliermondii,* 2 of *S. elongasporus,* 1 each of *S. melibiosi* and *C. parapsilosis* and *S. cerevisiae, C. tropicalis, K. lindneri, T. glabrata* and *Tr. fermentans.*

Several cultures failed to grow in 55° Brix medium, including all cultures of *Pichia,* and *R. glutinis, S. odorus, Z. mellis-aceti,* 1 culture of *C. guilliermondii* and several of *C. krusei. Tr. cutaneum* was most inhibited by high concentrations of sugar for it failed to grow in a 35° Brix medium.

Growth at low temperatures. A large number of organisms grew at 47° F. (8.5° C.) but relatively few developed at 37° F. (2.5° C.) *Saccharomyces oviformis, S. carlsbergensis* var. *mandshuricus, S. elongasporus, Candida melibiosi, C. pulcherrima, Z. fermentati, R. glutinis* and *Sporobolomyces odorus* were the only organisms that grew at 37° F. (2.5° C.); none grew at 32° F. (0° C.) although red yeasts causing the spoilage of oysters grow at freezing temperatures.

Aside from certain species of Saccharomyces (particularly *S. elongasporus*), *C. melibiosi* and *K. jensenii,* the organisms most commonly encountered showed little tendency to grow at low temperatures.

Growth at low pH. Over half the cultures (54) grew at pH 1.5 and practically all at pH 2.0. Although *Tr. cutaneum* failed to grow at pH 3 the results verify the belief that yeasts in general can tolerate and grow in media having very low pH values.

SUMMARY AND CONCLUSIONS

Ninety-two yeasts were isolated from various sources in citrus processing plants. Species of *Candida, Zygosaccharomyces, Hanseniaspora, Saccharomyces* and *Pichia* were most commonly isolated. Relatively few

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[b] *Saccharomyces elongasporus nov. sp. In extracto maltoso cellulae ovatae sive ellipticales crescunt singulae vel binae; post tres dies cellulae (2.8-5)μ × (3.5-5.6)μ: in herbacis agaro cellulae (2.8-6.3)μ × (2.8-7.7)μ. Formatur anulus tennis; ascosporae paucae in agaro Garodkowa; plerumque una aliquando duae ascosporae elongatae, implentes ascum: fermentatio glucosi et galactosi (exiguis); assimilantur glucosum, galactosum sucrosum et maltosum sed non lactosum. Utuntur peptono, asparagino, $(NH_4)_2SO_4$ et ureo (exigue) sed non KNO_3.*

Cultura levis nitida mollis, forma convexa margo pseudomycelium.

[c] *Torulopsis citrus nov. sp. In extracto maltoso et in herbacis agaro cellulae (1.4-2)μ × (2.8-4.2)μ: Pleurumque cellulae crescunt fasciculae, sed aliquando singulae sive binae. Fermentatio glucosi, maltosi et galactosi (exiguis). Assimilantur glucosum, galactosum et maltosum. Utuntur aspargino, $(NH_4)_2SO_4$, peptono, ureo (exigue) et KNO_3. In medio aethyli alcoholis non incrementum cellularum. Cultura ocrea, levis, mollis, forma convexa margine integro.*

TABLE 2
Growth of yeasts under various conditions

Organism	Number of cultures	Sugar Concentration in ° Brix (a)			Incubation Temperature ° C. (b)				pH of Medium (c)			
		45	55	65	2.5	5.0	8.5	10.0	3.0	2.5	2.0	1.5
C. krusei	1	±	−	−	−	−	−	+++	+++	+++	+++	+
C. krusei	12	+++	±	−	−	−	±	+++	+++	+++	+++	+
C. guilliermondii	1	+++	±	−	−	−	−	+++	+++	+++	+++	±
C. guilliermondii	2	+++	+	−	−	++	++	+++	+++	+++	+++	±
C. guilliermondii	3	+++	+++	±	−	−	−	+++	+++	+++	+++	±
C. parapsilosis	3	++	±	−	−	−	−	+++	++	++	+	−
C. parapsilosis	1	++	++	−	−	++	++	+++	++	++	±	−
C. melibiosi	4	++	+	−	+	++	++	+++	++	++	+	−
C. pelliculosa	1	++	+	±	−	++	++	+++	+++	++	+	+
C. tropicalis var. lambica	1	++	++	+	−	−	−	++	++	++	++	±
C. pulcherrima	1	++	++	−	−	++	++	+++	++	++	+	±
C. melinii	1	+	+	−	+	+	+	+++	++	++	+	−
Z. vini	4	++	++	++	−	−	−	+++	+++	++	±	−
Z. major	2	+++	+++	++	−	−	−	+++	++	++	±	−
Z. fermentati	2	+++	++	±	−	+	++	+++	+++	+	−	−
Z. japonicus	2	+++	+++	+++	−	−	±	+++	++	+	±	−
Z. priorianus	1	++	++	+	−	−	−	+++	++	++	±	−
Z. manshuricus	1	++	++	++	−	−	−	+++	++	++	±	−
Z. mellis aceti	1	±	−	−	−	−	−	+++	++	++	+	+
Z. globiformis	1	++	++	−	−	+	+	+++	+++	+	±	−
H. melligeri	5	++	±	−	−	−	+	+++	+++	++	++	+
P. fermentans	4	++	−	−	−	−	±	+++	+++	+++	+	±
P. chodati var. fermentans	1	±	−	−	−	−	−	+++	++	++	+	±
S. cerevisiae	3	+++	+++	−	−	+	+	+++	++	++	±	−
S. exiguus	1	++	±	−	−	−	−	+++	+++	++	+	+
S. oviformis	1	+++	++	−	+	+	+	+++	+++	+++	±	−
S. carlsbergensis var. mandshuricus	1	+++	+	−	±	+	±	+++	+++	+++	+	±
S. elongasporus nov. sp.	3	++	++	−	±	++	++	+++	+	+	+	±
K. jensenii	3	++	±	−	−	+	+	+++	+++	+++	++	++
K. lindneri	1	++	++	±	−	−	−	+++	+++	+++	+++	±
K. lindneri	1	++	±	−	−	−	++	+++	+++	+++	+	+
R. glutinis	1	++	−	−	+	++	++	+++	++	++	+	−
R. glutinis	1	++	−	−	−	−	++	+++	++	+	+	−
R. mucilaginosa	1	++	+	−	−	++	++	+++	+++	+++	+++	+
O. lactis	1	+	+	−	−	−	+	+++	+++	+++	−	−
Tr. cutaneum	1	−	−	−	−	−	−	+++	−	−	−	−
Tr. fermentans	1	++	+	±	−	−	−	+++	+++	++	++	±
H. anomala	1	+++	++	−	−	++	++	+++	+++	++	++	±
T. glabrata	1	++	+	±	−	−	−	+++	++	++	++	+
T. citrus nov. sp.	1	++	±	−	−	−	−	+	+	+	+	±
Sp. odorus	1	+	−	−	++	++	++	+++	++	++	+	−

(a) All organisms were able to grow in 35° Brix medium except *Tr. cutaneum*. None grew in 75° Brix medium. (b) All cultures grew well at 14° C. and none at 0° C. (c) With the exception of *Tr. cutaneum* all yeasts grew well in the medium at pH 3. None grew at pH 1.1.

could grow in 65° Brix medium or at 37° F. (2.5° C.). Two new species, *Torulopsis citrus* nov. sp. and *Saccharomyces elongasporus* nov. sp. are described. The latter is most interesting since it was isolated from orange concentrate and can tolerate lower temperatures, 37° F. (2.5° C.). From a taxonomic point of view it is unique in that it forms elongate spores that nearly fill the cell. Morphologically it does not resemble *Nematospora* in any way.

The complete absence of *Nematospora* and the isolation of but one culture of *Hansenula* was surprising. *Trichosporon cutaneum* and *Torulopsis glabrata* apparently were isolated from a food product for the first time.

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Research on Flexible Films for Food Packaging[a]

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It is evident there is an ever-increasing growth in the use of flexible, transparent films for packaging foods. Almost daily new uses become evident on store shelves, and alert advertising groups are beginning to refer to the sanitary and utility features of transparent plastic films as added advantages for the consumer. Consumer preference for transparency and for a clean, fresh, appealing appearance in a product is well established. Other packaging materials—such as metals, glass and paper—are necessary and desirable, of course, and consumer reaction would actually show preference for these materials for many items; nevertheless, development of high-speed equipment for manufacturing, converting, wrapping and sealing plastic films has resulted in the greatly expanded use of flexible packaging materials for foods. The reduction of labor and material costs for the food packer has been yet another impetus to growth.

The expanded use of flexible films for food has not been automatic. Rather, it has taxed the energy and ability of the packaging technician, machinery designers, engineers, converters, and printers. In the packaging of dairy products, and particularly cheese, both natural and process, transparent, flexible wrappings have many desirable features but many complex problems are presented. In the first place, the nature of these products places exacting requirements on the films used. A brief examination of the various factors brought to bear on solving a problem faced by this industry and its suppliers of wrappers for consumer units is the purpose of this paper.

A TYPICAL PROBLEM

Process cheese is a pasteurized product delivered to the package in a hot, viscous mass. This immediately places a dimensional heat stability requirement on the material. If there is an undue shrinkage character in the film, the package becomes distorted. If there is undue stretching or loss of rigidity by the material when hot, it becomes quite difficult to handle through automatic filling and closing equipment. This requires certain predictable folding characteristics. Softness or lack of rigidity when in contact with the hot product and its vapors complicate the filling operation because the sides of the pre-formed pouch collapse before the fill is complete or the seal is made. This factor has eliminated many films from consideration and has influenced the selection of non-thermoplastic sheets, such as cellophane, as one component of the process cheese wrapper. Many films are not affected by the humidity involved, but the temperatures they are subjected to cause them to become extremely pliable even though they are rigid enough at room temperature.

Sealing. Since the product is a sterile one and is subjected to deterioration from mold, yeast and bacteria, it is indicated that an hermetic type of seal be used. It will be seen that the structure of the present commercial wrapper has much to do with solving the sealing problem.

A regenerated cellulose was selected as our base sheet. A higher degree of heat sealability was therefore an immediate requirement in the specification for a wrapper. Although the heat-sealing type of cellophane is here indicated, due to other requirements placed on the wrapper, it is better to apply a thermoplastic heat-sealing coating to the base sheet. This coating must have a sealing and softening or flow temperature above the filling temperature of the product; it must not melt away or

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loosen itself from the base sheet; and it should be transparent so that the product may be clearly seen. Naturally, the retention of moisture by the wrapper is necessary and an extremely low moisture-vapor transmission rate must be obtained. Our regular moisture-proof cellophane proved to be not good enough alone in this respect, and it was necessary to use additional moisture barriers. Heavy thermoplastic coatings have been developed which, when applied to the base sheet, give the necessary lower moisture-vapor transmission; at the same time these coatings have solved the sealing problem just mentioned.

Other functions. The coating used for process cheese wrappers must also serve other functions since sealability and moisture-proofness are only part of the story. Process cheese, as well as cheese foods, requires protection against oxygen. This is needed to prevent the development of mold-growth, rancidity of fat components and other oxidative reactions that will affect the quality and appearance of the product.

Let us consider the wrapper further. Our base sheet of cellophane is an excellent gas barrier when the sheet is dry. However, when wet or in high humidities this property is lost to a great degree, and so we must protect it from the wet product. Our thermoplastic sealable and moisture-proof coating must therefore serve as a protective barrier to the base sheet. If the thermoplastic coating keeps the cellophane from becoming moist and thereby losing its gas retention properties, it naturally serves the additional function of acting as a flavor retention barrier.

Although we have now written many stipulations into our specification, and have a dimensionally stable, heat-sealable, moisture-proof and essentially gas-proof wrapper, we are still not satisfied. The fat content of the product is such that unless precaution is taken it will deteriorate the coating used to protect the base sheet. This means that the thermoplastic coating must be quite resistant to deterioration from fat or oil; the ultimate quality of the wrapper will be judged with this in mind. This "ultimate" quality is not easy to achieve, however, due to still other requirements.

The wrapper must cling close to the product and in effect have a certain affinity for the product. This will reduce the chance for oxygen or air to be trapped on the surface of the cheese, between cheese and the wrapper, and will reduce the areas under which mold may develop, appreciably adding to the appearance and life of the product. The coating, therefore, must have an affinity for fat and moisture, but not be destroyed by fat or moisture. Commercial wrappers have been developed that fit these requirements and the industry has been using them for some years.

Of course, the wrapper must be sterile, odorless, of food grade materials, able to take print effectively, and finally, show sufficient strength to hold the usual one-half pound, one-pound, 2-pound, and 5-pound units.

Our functional specification now reads: "A dimensionally stable, heat sealable, moisture-proof and essentially gas-proof wrapper that shows an affinity for the product and is grease resistant, odorless, tasteless, and sufficiently strong to carry the weight of the product."

Packages for natural cheese. In the case of natural cheese packages, many of these same factors must be maintained. However, the wrapper is not ordinarily subjected to the same heat requirements. Therefore, other films have been found to be adaptable. Further, the intended shelf life and method of distribution of the product will normally determine the degree of moisture-vapor transmission and gas permeability the sheet may have. The exclusion of air or oxygen is vitally important for mold control and is normally sought as the prime requirement of a good cheese wrapper.

RESEARCH CONSIDERATIONS

The preceding brief account should have served to emphasize that the successful use of flexible packaging materials is the result of the study of many factors. These factors should balance in a way to enable the researcher to obtain a suitable compromise to satisfy a, production conditions, b, method of distribution and merchandising systems, c, shelf life requirements, d, quality control standards, e, advertising needs, and, finally, f, cost limitations.

One of the first steps to be taken in studying a packaging problem is to recognize the details of the processing procedure and the production facilities that can or may be employed. Matters such as temperature and physical form of the product at time of packaging, the size of the units to be packaged, speed of packaging, and subsequent handling procedures—all combine to form a check list against which the available films or materials may be considered. Study of the foregoing will show the thermal stability requirements that will be placed on the films, the rigidity requirements, and the folding characteristics necessary. They will also determine the type of seal and whether the material is to be in sheet, roll, bag, or tube form. Subsequent physical tests will directly determine whether or not the materials available can be made to meet these requirements.

The chemical properties of the product should be ascertained by the investigator to determine the protective properties required. This includes such factors as moisture equilibrium, salt, acid, and free oil content. These points once established will lead to determining the series of properties that will be required of the films or laminations under consideration. Such things as moisture transmission rates, oil resistance, gas permeability, etc., all must be known. Some of these factors may be compensated for by increasing the gauge of the films or protective coatings on the base sheets under consideration.

Consideration should also be given to actual packaging tests. These should be of two kinds: a, actual full-life storage under actual conditions of temperature, humidity, and b, light, as well as accelerated, tests under those conditions known to be most detrimental to the quality of the product. Eventually, properly established accelerated tests can be developed by the investigator to reduce greatly the time necessary to predict shelf life. All tests should be conducted on fully printed or converted materials. By these tests, we should arrive at a package that adequately protects the product, is engineered correctly to production, is economically sound—and pleases the consumer.

Films. The number of films available for research are largely limited to cellophane, pliofilm, polyethylene, Saran, acetate and foil. However, these materials may be combined with each other and coated with a host of materials. The number of possibilities for experimentation is unlimited. The investigator is fortunate in that much research information can be had from the manufacturers and converters.

Future research. The perfect process cheese package has not, of course, been made. Research in this field is continuing in an effort to obtain greater resistance to gas permeability and moisture by the use of new coatings for new base sheets that will surpass the present types. Greater grease resistance, less delamination or separation of coatings and base sheets at refrigerated temperatures and improved gas impermeability are still the major problems. Easier opening and better reclosure features for consumer convenience are also being sought. In other words, there will be no shortage of research problems on flexible films for some time to come.

The Control of Thermophilic Bacteria[a]

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The practical sterilization of food ingredients for thermophilic organisms has been accomplished by treatment of the material under vacuum with an epoxide such as ethylene oxide. The treatment is described and data given indicating the effectiveness of the process on various products.

For the past 14 years in our company the epoxide, ethylene oxide, has been used for the practical sterilization of foods and food materials without material reduction in their nutritive value, or in potency, or in modification of their flavor characteristics *(2)*. This paper reports the effectiveness of the ethylene oxide treatment on thermophilic bacteria for improving the quality and stability of some foods and food products.

Thermophiles and heat-resistant spores, which are commonly produced by thermophilic spore-forming bacilli, have proved to be quite bothersome to the canners as well as to the food industry as a whole. Although many cell-proteins are coagulated by temperatures of 55° to 60° C. (131° to 140° F.) most of the thermophiles grow readily at these temperatures; a few are even able to grow at 70° to 80° C. (158° to 176° F.). The resistance of thermophilic organisms to heat varies with temperature and time. For example, the thermal death time at 140° C. (285° F.) is one minute, whereas at 120° C. (248° F.) it is 23 minutes, and at 110° C. (230° F.) it requires 225 minutes according to Bigelow and Esty *(1)*.

While ethylene oxide is toxic to the micro-organism, it is non-toxic in the treated material since all traces of it are eliminated upon completion of the treatment. Many tests have indicated this absence. To avoid flammability, carbon dioxide has been combined with ethylene oxide in the proportion of 9 to 1. In our process undiluted ethylene oxide is used and all equipment is grounded and made explosion-proof. Special exhaust fans are used for the proper air evacuation in the retort room. Three reservoir tanks containing water are used to dilute the evacuated gas from the retorts before final disposal in the sewer. Precautionary measures and devices have eliminated chance explosions in our process. In the years of commercial operation there has been no accident causing either injury to personnel or damage to equipment.

In this discussion, we must distinguish between fumigation and sterilization. Generally speaking, fumigation indicates primarily the eradication of insect life and not specifically the destruction or substantial elimination of micro-organisms, as is indicated by sterilization. Publications on ethylene oxide and its admixture with carbon dioxide have been mostly limited to pest control. Yesair and Cameron's *(7)* results on experiments conducted on the treatment of spices confirmed the work by Hall *(3, 4)* and showed that practical sterility of spices was obtained by the use of undiluted ethylene oxide. There is a considerable amount of literature available on the use of chemicals for destroying or lessening bacterial activity in various products, but in most instances the substances used are not applicable to food products or food ingredients.

It must be noted that the various vegetable materials treated with undiluted ethylene oxide have a heterogenous bacterial flora. To note the reaction of ethylene oxide on various metabolic types, pure suspension of six organisms was studied by Vaughn, Haas and Mrak.[c] Their results are shown in Tables 2, 3, and 4.

To give a better appreciation of the problem of sterilization by the ethylene oxide process, the properties of the gas are shown in Table 1.

Vaughn, Haas and Mrak also made a comparative study on the time required for ethylene oxide to kill the

[a] Presented before the Twelfth Annual Meeting of the IFT, Grand Rapids, Mich., June 11, 1952.

[c] Unpublished data of Vaughn, Haas and Mrak used here with the authors' permission.

TABLE 1[b]
Properties of ethylene oxide

Molecular Weight	44.0
Boiling Point	51.3° F.
Freezing Point	—168.2° F.
Flash Point (TAG Open Cup)	below —4.0° F.
Fire Point (TAG Open Cup)	below —4.0° F.
Specific Heat, Btu./(lb.) (° F.)	0.44
Heat of Vaporization (1 Atm.), Btu./lb.	245.0
Density, g./cc.	0.896-32° F.
Refractive Index	1.3614-39.2° F.
Explosive Limits (% Volume in Air)	∝
Water Solubility, g./100 g. at 77° F.	∝
Alcohol Solubility	2—100
Ether Solubility	100

[b] The Dow Chemical Company.

TABLE 2[d]
Effect of ethylene oxide on bacterial suspensions

a) Lactic acid bacteria (heterofermentative culture No. 0-1)			b) Lactic acid bacteria (homofermentative culture No. 0-7)		
Time in hours	1% ethylene oxide organisms/cc.	Distilled water organisms/cc.	Time in hours	1% ethylene oxide organisms/cc.	Distilled water organisms/cc.
0	.....	141,000,000	0	.....	97,000,000
1	160,000,000	.....	1	71,000,000	.....
2	152,000,000	.....	2	72,000,000	62,000,000
4	1,200,000	142,000,000	4	61,000,000	44,000,000
7	8,100,000	195,000,000	7	3,900,000	57,000,000
13	7	110,000,000	13	0	46,000,000
24	0	165,000,000	24	0	22,000,000

[d] Unpublished data of Vaughn, Haas and Mrak.

TABLE 3[e]
Effect of ethylene oxide on bacterial suspensions

c) Aerobacter (culture No. A-8)			d) *Bacillus Subtilus*		
Time in hours	1% ethylene oxide organisms/cc.	Distilled water organisms/cc.	Time in hours	1% ethylene oxide organisms/cc.	Distilled water organisms/cc.
0	.....	1,020,000,000	0	.....	28,000,000
1	630,000,000	.....	2	260,000	28,000,000
2	136,000,000	710,000,000	4	1,000	21,900,000
4	3,300,000	880,000,000	23	100	21,000,000
7	720	920,000,000		0	3,500,000
13	0	82,000,000			
24	0	770,000,000			

[e] Unpublished data of Vaughn, Haas and Mrak.

TABLE 4[f]
Effect of ethylene oxide on bacterial suspensions

e) Acetobacter sp.			f) Butyribacterium sp.		
Time in hours	1% ethylene oxide organisms/cc.	Distilled water organisms/cc.	Time in hours	1% ethylene oxide organisms/cc.	Distilled water organisms/cc.
0	.....	3,920,000	0	.....	93,000,000
4.5	0	2,300,000	4	1,500,000	75,000,000
8	0	1,800,000	8	0	72,000,000
24	0	1,400,000			

[f] Unpublished data of Vaughn, Haas and Mrak.

vegetative cells and spores of *Bacillus subtilus* as indicated in Table 5.

The foregoing data of Vaughn, Haas and Mrak indicates that by using 1% ethylene oxide at room temperature the time required to destroy the various metabolic type vegetative cells was 13 hours while 25 hours were required to reduce the spore count to less than 100 organisms per milliliter. Such a procedure could not be used commercially because of the time lag. By the ethylene oxide process comparable effective results can be obtained in a much shorter time (6 to 8 hours), but it should be stated that the concentration of the ethylene oxide is considerably greater.

TABLE 5[g]
Effect of ethylene oxide on a spore suspension of Bacillus subtilus

Total count (vegetative cells and spores) after treatment			Spore count (80° C.-10 min.) after treatment		
Time in hours	1% ethylene oxide organisms/cc.	Distilled water organisms/cc.	Time in hours	1% ethylene oxide organisms/cc.	Distilled water organisms/cc.
0	13,700,000	12,200,000	0	.....	.....
6	3,200,000	15,100,000	6	.....	.....
19	6,000	11,800,000	19	180	14,800,000
25	27	23,000,000	25	.....	.....
43	0	14,100,000	43	0	19,000,000

[g] Unpublished data of Vaughn, Haas and Mrak.

Further, the results of Table 3 and Table 5 showing the difference of resistance of the vegetative cell and the spore of *Bacillus subtilus* are closely related to the findings made by many investigators including Williams and Zimmerman *(6)*. The evidence clearly indicates that the resistance of a vegetative cell and spore of the same organism is unrelated.

Appreciating the difficulty of eliminating thermophilic spores, yet realizing the effect such a bacterial load would have in some canned products, the National Canners Association set up the following standards for thermophiles with a maximum tolerance as noted below:

Flat sours: Maximum of 75 spores for any one sample, or an average of not over 50 spores for 5 samples.

Total thermophiles: Maximum of 150 spores for any one sample, or an average of not over 125 spores for 5 samples.

Anaerobes not producing H_2S: Not over 3 of 5 samples (60%) positive, or not over 4 or 6 tubes (67%) for any one sample positive.

Anaerobes producing H_2S: Not present in more than 2 of 5 samples (40%) or with not more than 5 spores per 10 g. in any one sample. This is equivalent to 2 spores in 6 tubes.

In the analysis of samples of various commercial materials, the method used, with but a few minor adjustments for special samples, is that given in the QMC Technical Bulletin No. 1 *(5)*. Data is herewith given on such analysis of treated and untreated materials as in Table 6.

Analyses of other untreated commercial samples have shown them to be highly contaminated with thermophilic organisms. For example, low fat, high fat and toasted soya flours have flat sour spore counts of over 1,000 spores per 10 g. Ground black pepper, paprika and red pepper have averaged never less than 950 flat sour spores and in many instances the counts have been too numerous to count. Thermophilic anaerobes in untreated spices have been found to exceed the maximum limits set by NCA. Following treatment with the ethylene oxide process, analyses have indicated not only practical sterility meeting NCA standards, but also in some instances a complete destruction of thermophilic organisms was possible. For further data on various other commercial samples one can refer to Hall *(4)*.

In their normally dry state, sterilized food materials can be kept for long periods of time without danger of the spore count increasing. In our company, we have often analyzed seasonings made with treated materials that have been stored for 12 months and have not found therein any appreciable differences in bacterial counts.

The thermophilic treatment of a food material involves subjecting the material for at least one hour to a predetermined temperature which is specific for the product being sterilized; introducing undiluted ethylene oxide gas under a high vacuum on the basis of approximately 1.6 pounds per 35 cu. feet of report space; subjecting the heated evacuated material for at least 2½ hours to the action of the gas; applying a second vacuum to withdraw any unused ethylene oxide gas, and finally washing the material with filtered dry air. The entire process takes approximately 6 to 8 hours depending on the material being treated. The treatment is effective when the material is packed in paper, burlap or cotton bags, multiwall paper bags and, in some instances, fiber drums.

TABLE 6
Typical thermophilic counts on commercial samples

Sample	Flat sour spores in 10 grams		Total thermophilic spores in 10 grams		% tubes positive anaerobes not producting H_2S		Anaerobes producing H_2S in 10 grams	
	Untreated	Treated	Untreated	Treated	Untreated	Treated	Untreated	Treated
Mustard Flour	110	0	110	0	....	....	....	....
Gelatinized Corn Flour	750	60	770	60	....	....	....	....
Gelatinized Wheat Flour	1540	50	1700	50	0	0	0	0
Yellow Corn Flour	1200	0	1500	0	0	0	0	0
White Corn Flour	260	0	350	0	0	0	0	0
Barley Flour	590	0	680	0	....	....	....	....
Corn Starch	225	0	585	0	33.3	0	0	0
Idaho Potato Flour	1620	0	2140	0	0	0	0	0

The first heating and evacuating step in the process frees the surface and intercellular spaces of the material from adsorbed and absorbed gases, some moisture and air. The material is thus activated so that the ethylene oxide can act on the microorganisms, probably by increasing the concentration locally by sudden changes in the osmotic tension of the product so that the epoxide acts upon the ruptured cells. There is much work to be done regarding the theory of the toxicity of the epoxide on microorganisms; however, the toxic effect of the epoxide is thought to be due to the respiratory action of the gas on the microorganisms.

EXPERIMENTAL

In treating spices with ethylene oxide we were interested to see whether there was any advantage in using treated or untreated spices in meat products. A study was made, therefore, to determine the keeping time, palatability and physical character of pork sausages using untreated and treated spices. The spices used in this experiment had the following total counts (Table 7):

TABLE 7

Microorganism content of spices used in pork sausage (number per gram)

	Untreated	Treated
Total Bacterial Count		
Ginger	920,000	6,000
Black Pepper	4,200,000	18,000
Sage	11,000	500
Red Pepper	3,800,000	22,000
Seasoning Mixture	125,000	500
Total Mold Count		
Ginger	1,700	0
Black Pepper	1,500	0
Sage	600	0
Red Pepper	1,200	0
Seasoning Mixture	480	0
Ground Meat Before Adding Spices		
Total Bacterial Count	110,000	
Yeast Count	1,500	
Mold Count	40	

The pork sausages kept under refrigeration at a temperature of 5°-7° C. (41°-45° F.) for 31 days were analyzed for their microorganism content and showed the following results (Table 8 and Table 9):

The sausage samples were made into patties and taste-tested at 2-day intervals. The sausage prepared with untreated spices began to show a marked unpalatable taste and a definite rancid flavor after ten days of storage. On the eleventh day the test was discontinued because of the very definite unpalatable taste of the sausage made with untreated spices.

The sausage prepared with the treated spices continued to remain palatable with no rancid flavor until the end of the fourth week when a slight rancid taste was noticed for the first time. The unpalatable character of the sausage was apparently due to the decomposition of the protein and the rancidity developed in the fat.

At the end of the test the fat was extracted from the sausages and the free fatty acids as oleic acid was found to be 2.08% for the sausage made with the untreated spices and 1.76% for the sausage made with the treated spices. It is to be noted that the hydrolysis of the fat to free fatty acids was higher in the sausage made with untreated spices. This should be expected since the enzymes, bacteria, yeast and molds in the untreated spices had not been inhibited or destroyed as they were in the treated. This experiment gave evidence that the sausage made with treated spices had a keeping time of approximately one month at 5°-7° C. (41°-45° F.), and that the sausages made with untreated spices, under the same conditions, had a keeping time of 10 days.

TABLE 8

Microorganism content of pork sausage kept under refrigeration (number per gram)

	Total bacterial count	
	Sausage made with untreated spices	Sausage made with treated spices
After 2 days	120,000	34,000
After 4 days	400,000	150,000
After 10 days	1,500,000	600,000
After 17 days	2,000,000	990,000
After 24 days	5,500,000	3,000,000
After 31 days	5,500,000	3,000,000

TABLE 9

Microorganism content of pork sausage kept under refrigeration (number per gram)

	Total yeast count	
	Sausage made with untreated spices	Sausage made with treated spices
After 2 days	750	150
After 4 days	1,500	800
After 10 days	10,000	8,000
After 17 days	90,000	33,000
After 24 days	170,000	114,000
After 31 days	600,000	250,000
Total mold count		
After 2 days	0	0
After 4 days	240	30
After 10 days	500	100
After 24 days	5,000	100
After 31 days	5,500	200

DISCUSSION

Our data and experimental work show that effective results are obtained when there is a definite temperature and vacuum-application cycle and a definite concentration of ethylene oxide.

In the ethylene oxide process the limits within which the coordinating factors operate effectively are predetermined to assure sterilization of the various types of materials treated without injurious effect in the appearance, flavor and other characteristic properties of the material.

SUMMARY

It has been shown that thermophilic bacteria can be controlled and greatly reduced in various food materials by a vacuum process using ethylene oxide. It has been of great assistance to food manufacturers in enabling them to obtain or produce food ingredients substantially free from troublesome microorganisms and has thus been of value as another positive control in enhancing the quality of their finished products.

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Color of Capsicum Spices. I. Measurement of Extractable Color

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A rapid spectrophotometric method has been developed to measure alcohol-extractable color of capsicum spices. The method employs a 10-cm. sample cell and involves transmission readings at 2 wavelengths. The accuracy of the spectrophotometric method surpasses that of the heretofore-used method, which employs Lovibond glasses.

Color is an important quality factor in many foods. This is particularly true of capsicum spices, which are often utilized for the specific purposes of imparting a red color to processed food products. It is of importance, therefore, to have available a reliable analytical method for the practical measurement of this color.

The most common method now in use is based upon the extraction of 0.1 g. of ground spice with 50 ml. of 95% ethyl alcohol or their equivalents. The filtered extract in a 5¼-inch column is matched against combinations of Lovibond red and yellow glasses. Since the capsicum spice color of interest lies in the red range, variations in the red values are of greater importance than in the yellow. Variations in the latter over a wide range have only a slight effect upon matching the red glasses, and it has become a widespread practice to use a 20-yellow glass and express the Lovibond value as the number of additional red units needed to obtain a match. Although no data have been published concerning the correlation of alcohol-extractable color with the performance of capsicum spices in processed food products, the widespread experience of the industry indicates that this color does correlate with the tinctorial value of these spices.

Much work has been published concerning the limitations of the Lovibond method for measuring color, particularly of vegetable oils. In order to increase the accuracy of the method, the American Oil Chemists' Society certifies referee chemists upon their experience and ability to periodically analyze check samples within prescribed limits. Measurement of color of capsicum-spice extracts, however, falls outside of the range of colors normally measured in vegetable oils, and available data (unpublished) show much greater discrepancies between measurements of capsicum-spice extracts than between those of vegetable oils.

Thus, while the Lovibond system is widely used in the measurement of color of capsicum spices, there are inadequacies inherent within it. Its principal disadvantage lies in the fact that it is subjective, and, as such, is susceptible to the many errors associated with variations in the color-observing sensitivities of different observers and also the day-to-day variations which occur within a single observer. These sources of error are particularly evident when 2 color systems being matched subjectively have different spectral-transmission properties.[a] It will be shown later that such is the case when the color of alcohol extracts of capsicum spices is matched with Lovibond red and yellow glasses. Therefore, in spite of the fact that most laboratories use standardized glasses, the method is still a source of large inaccuracies. It is the purpose of this paper to describe the development of an objective method, hereafter called the Gentry method, for measuring the alcohol-extractable color of capsicum spices.

[a] A better understanding of this point may be obtained by reading reference *(3)*, pages 25-28.

PRINCIPLE OF METHODS

A color can be described by terms which designate its brightness, hue and saturation *(6)*. In the Lovibond method for measuring color of capsicum spices, differences in brightness between the sample and the Lovibond glasses are ignored by the observer making the match. Consequently, in the present investigation, no attempt has been made to measure the brightness of the samples by objective methods. However, it should be mentioned that if, at some future date, it becomes desirable to consider brightness in specifying the color of capsicum spices, a rapid objective method could be developed, using the same principles employed in the present investigation.

A convenient way to describe hue and saturation (chromaticity) is by the method of the International Commission on Illumination—a procedure for color notation employing trichromatic coefficients *(2)*. These coefficients define color in terms of "fractional (x, y, z) amounts of three imaginary red, green, and blue lights, necessary for an imaginary standard observer to match a given sample under a given illuminant" *(5)*. Since, by definition, the sum of the trichromatic coefficients $(x + y + z)$ equals unity, chromaticity of a sample is completely designated by any two of these coefficients.

The samples studied in the present investigation transmitted only insignificant amounts, if any, of blue light. The z (or blue) coefficient in all cases equalled zero when calculated for Illuminant C, the standard which approximates average daylight and which is usually employed in colorimetry *(2)*. By examining a C. I. E. (x, y)-color mixture diagram *(2)*, it is readily seen that when z equals zero, saturation always equals 100%. Under these circumstances, the only attribute of chromaticity which varies is hue, and hue can be conveniently described by either x or y, since $x + y = 1$. Thus a convenient 1-dimensional scale which can be compared directly with the 1-dimensional red scale of the Lovibond method is arrived at.

In the Lovibond method, the color of light transmitted by 5¼ inches of the sample is measured. Thus, in order to determine chromaticity spectrophotometrically, a 5¼-inch sample cell should be used. This is not a standard dimension and such cells and corresponding cell-holder, etc., are not available unless specially constructed. Rather than do this, a 10-cm. cell (standard size) was employed and the values obtained were used to calculate transmittance for a 5¼-inch light path, using Bouguer's law, $T = t^x$, where T is the transmission factor for a thickness x, and t is the transmission factor for unit thickness *(2)*. This procedure could not be followed accurately with a 1-cm. cell, because in this case all of the significant transmission factors (those above 500 mμ) would be above 0.9. This would narrow the working range and hence the sensitivity of the method. It would also involve using a range in which the sensitivity of the spectrophotometer is low. Attempts to correlate trichromatic coefficient x (as calculated for a 5¼-inch light path, from data obtained with a 10-cm. cell) with transmission values at 2 wavelengths (including those above and below 500 mμ) using a 1-cm. cell did not prove successful. It will be shown later in this paper that trichromatic coefficient x can be estimated from transmission values at 2 wavelengths if a 10-cm. cell is employed.

METHODS AND MATERIALS

Trichromatic coefficient x values have been determined for 135 samples, using the Thirty Selected Ordinate method for Illuminant C *(2)*. Lovibond red values (always in combination with 20 yellow) were also determined for these samples. The Lovibond and x determinations were always made within 3 hours of each other. This was done in order to avoid any small color changes which may occur in solutions standing for appreciable periods of time. All Lovibond determinations were made by Geo. W. Gooch Laboratories of Los Angeles, California, and except for 4 samples, they were made by one observer. This observer had extensive experience and an excellent record in measuring the color of both edible oils and extracts of capsicum spices by the Lovibond method.

All spectrophotometric data were obtained with a Beckman Model DU Spectrophotometer, employing 10-cm. cells. The wavelength and photometric scales of the spectrophotometer were checked prior to the start of the investigation. For checking wavelength, a mercury arc was used. The scale was adjusted to the 546.1-mμ line and then checked at the 435.8 and 578.0-mμ (577.0 and 579.1-mμ) lines. The photometric scale was checked with a carbon yellow glass standard, obtained from the National Bureau of Standards. In each case the usual slight deviations were detected, but these were not significant enough to affect adversely the over-all goal of the present investigation.

Transmission values were obtained at each of the wavelengths designated in the Selected Ordinate method for Illuminant C employing 30 ordinates *(2)*. The wavelength settings always were approached from the same direction to avoid possible errors due to backlash. The meter needle was set at zero by adjusting the sensitivity knob, with the blank cell (containing alcohol) in the light path and the selector switch set at "check." A constant slit width of 0.04 mm. was employed. All readings were made with the temperature of the sample between 22 and 24° C.

The samples examined were representative of the capsicum-spice line. Both domestic and imported red-fruited samples varying in character from the large-fruited paprikas and chili peppers to the very pungent small-fruited chillies were examined. These constituted different varieties of the species *Capsicum annuum*, and one representative of the species of *Capsicum frutescens (7)*. In addition, samples of oleoresins were examined as well as chili powders consisting of blends of chili peppers with various other spices. The samples were obtained from widely varying sources so that a complete representation of the capsicum-spice supply was assured. The samples embraced a range from 11 to 36 Lovibond red units. At the present time this is the range of importance in the capsicum-spice industry.

Usually, 0.1 g. of ground sample was extracted overnight at room temperature with 50 ml. of 95% alcohol. However, in some cases different quantities (0.5 g. and 250 ml.), a longer extraction time (65 hours), and higher temperatures (30° C.) were employed. It should be pointed out that the present investigation was concerned only with color measurements of alcohol extracts of capsicum spices. Studies on the methods for obtaining these extracts are not reported here. Such studies are being made and will be published when completed. For the present, it suffices to report that variations in extraction techniques have not produced any extract whose color could not be measured satisfactorily by the Gentry method.

DEVELOPMENT OF GENTRY METHOD

After spectral transmission characteristics had been determined for numerous samples, it became evident that for practical purposes, 2 pigment groups could be considered to be responsible for the color of the alcohol extracts. The main group, presumably composed of carotenoid pigments, absorbed strongly in the blue. The second group was characterized by absorption in the red, and in this respect resembled the chlorophylls. For purposes of convenience, in this paper, the latter are referred to as chlorophyll-like pigments. They were sometimes absent, but when present, were quantitatively independent of the carotenoid concentration. Thus it became apparent that in order to determine chromaticity, a minimum of 2 wavelengths must be employed. Theoretically, transmittance at one wavelength should be a quantitative measure of the carotenoid pigments, and transmittance at the other wavelength, a quantitative measure of the chlorophyll-like pigments. Actually, the point of interest is not the quantitative concentrations of these pigments but rather the nature of the color which results from their selective absorption of light. However, the final color of the solutions will depend upon their quantitative concentrations. The greater the concentration of the carotenoid pigments, the redder the solutions will be, and the greater the concentration of the chlorophyll-like pigments, the less red the solutions will be.

In selecting the 2 wavelengths, consideration was given to the fact that for greatest sensitivity with the Beckman Model DU Spectrophotometer, the transmission scale between 20 and 80% should be used. However, it was found that the range of samples studied was too large to permit the selection of a satisfactory single wavelength, for measuring the carotenoid pigments, which would give values within this transmission scale range. In order to overcome this difficulty, the samples were divided into 2 sections—one containing samples of lower Lovibond values and the other samples of higher Lovibond values. Several wavelengths were considered for each section, and it was found that of these, 569 and 577.5 mμ proved the most satisfactory for the lower and higher Lovibond sections, respectively. Thus, if a sample had less than 20% transmittance at 569 mμ, it was placed in the higher Lovibond section where 577.5 mμ was used. A wavelength of 663 mμ proved satisfactory for deriving an expression which would take into account the red light absorbed by the chlorophyll-like pigments. The following equations were thereby developed:

Equation 1:

$$\text{Gentry units} = T_{569} + 0.2\,(100 - T_{663})$$

Equation 2:

$$\text{Gentry units} = T_{577.5} + 0.2\,(100 - T_{663}) - 14.2$$

where,

T_{569}, $T_{577.5}$ and T_{663} = percent transmittance at 569, 577.5 and 663 mμ, respectively, for a 10-cm. light path.

In Equations 1 and 2, the principal factor for calculating Gentry units is T_{569} or $T_{577.5}$, respectively. As the carotenoid concentration increases, these values will decrease, resulting in a lower Gentry unit which indicates a greater amount of red color. The factor $(100 - T_{663})$ is employed to account for the decrease in red color due to absorption by the chlorophyll-like pigments. The higher the concentration of these pigments, the smaller will be the T_{663} value and hence the greater will be the $(100 - T_{663})$ value. Since the factor $(100 - T_{663})$ is preceded by a plus sign, it follows that the greater the chlorophyll-like pigment concentration, the greater will be the Gentry unit, or, in other words, the lesser will be the amount of red color. The absorption of the chlorophyll-like pigments in the red is at a maximum between 660 and 670 mμ. Since the standard observer is relatively not very sensitive to light in this range *(2)*, the correction necessitated by this absorption need only be small. For this reason, the factor $(100 - T_{663})$ is multiplied by the constant 0.2. The latter was empirically derived by trying a number of different constants and determining which gave the least deviations from the line of best fit when Gentry units were plotted against trichromatic coefficient x.

The constant 14.2 in Equation 2 was arrived at in the following manner: Trichromatic coefficient x values were plotted against Gentry units as obtained by Equation 1, and also against Gentry units as obtained by Equation 2, using 0 in place of 14.2. The 2 curves thus obtained were fitted together to obtain a continuous curve and a linear and continuous abscissa scale of trichromatic coefficient x values. In order to also make the Gentry unit scale (the ordinates) linear and continuous, it was found that 14.2 had to be subtracted from all those values obtained using Equation 2 as just described above. The use of the constant 14.2 in Equation 2 is theoretically correct only if a marked degree of parallelism occurs between the wavelengths 569 and 577.5 mμ in the transmission curves of all samples studied. This was found to be the case. As a further test of the validity of using this constant, Gentry units were calculated for a number of samples (in the range where the use of Equations 1 and 2 overlap) using both Equations 1 and 2 for each sample. In each case the 2 values obtained for each sample were comparable within the limits of experimental error of the Gentry method.

It has been stated above that either 569 or 577.5 mμ could be used to measure the carotenoid pigments. The reader may question the validity of this because the chlorophyll-like pigments might also absorb at these wavelengths and thus interfere with an accurate measure of the carotenoid pigments. In practice, it has not been found necessary to consider absorption by the chlorophyll-like pigments at these 2 wavelengths for the following reasons: a, the chlorophyll-like pigments are present in relatively small quantity as compared with the carotenoid pigments; b, the absorption of the chlorophyll-like pigments at 569 or 577.5 mμ will bear a quantitative relationship to the absorption of these pigments at 663 mμ, and since the expression " + 0.2 (100 — T_{663})," which is used to correct for the absorption of chlorophyll-like pigments at 663 mμ, was derived empirically (derived so that Gentry units correlated well with chromaticity), it will also correct for the relatively slight absorption of the chlorophyll-like pigments at 569 or 577.5 mμ.

Either Equation 1 or 2 was applied to all samples examined. The Gentry units thus obtained were plotted against trichromatic coefficient x values as shown in Figure 1. Figure 2 shows x values plotted against Lovibond red units. Since it is the practice to describe the color of capsicum spices in terms of Lovibond red, Gentry units are plotted against Lovibond red in Figure 3.[b] Examination of this plot reveals that as the Lovibond red value increases, the Gentry value decreases. It may be also seen that theoretically it is possible to obtain a value of 0, or even a negative Gentry value.

[b] A convenient table for converting Gentry units to Lovibond red units is available upon request from the authors.

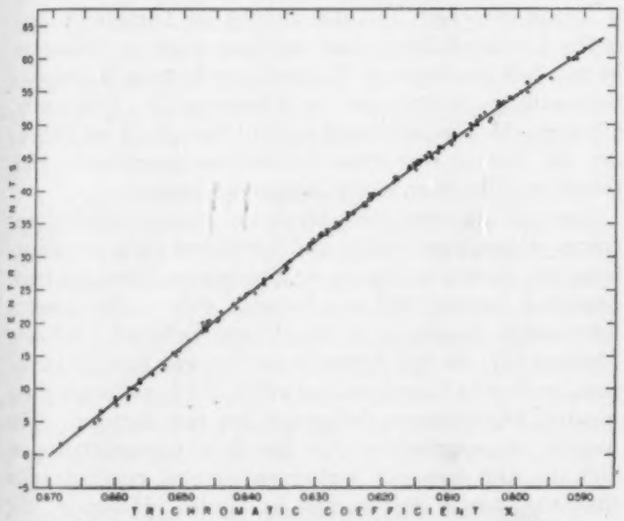

Figure 1. Gentry units versus trichromatic coefficient x.

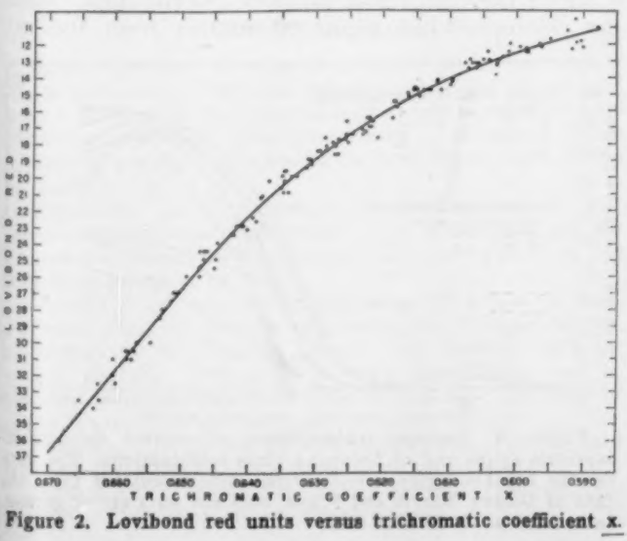

Figure 2. Lovibond red units versus trichromatic coefficient x.

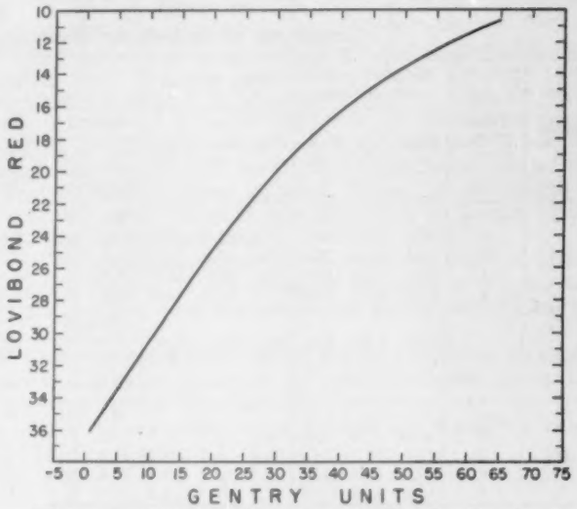

Figure 3. Gentry units versus Lovibond red units.

RESULTS AND DISCUSSION

The Lovibond red units used in the present investigation represent a scale of values obtained mostly by a single observer. It is very probable that this scale would have been significantly different if another observer had been used instead. Actually, the nature of the scale employed is of little importance as long as it can be made permanent, measured accurately, and be practically interpreted and applied. The scale proposed in the present investigation fulfills these criteria.

An illustration of the comparative accuracy of the 3 methods used in the present investigation to measure the color of capsicum extracts is given in Table 1. In order to facilitate comparison, the results are all expressed in Lovibond red units. It should be kept in mind, when considering the inaccuracies in the Lovibond method indicated in Table 1, that these are much greater than those normally obtained with the Lovibond method for measuring the color of edible oils. A much higher degree of accuracy can be obtained for these oils which usually have Lovibond red values lower than 11.1, the lowest value studied in the present investigation.

The samples studied in Table 1 were obtained in the following manner: Two oleoresins were prepared, one from the ground capsicum sample which was known to contain no chlorophyll-like compound, and the second from a sample which was specially blended to contain relatively large quantities of these compounds. At the start of the experiment, several portions of the 2 oleoresins were accurately weighed into individual bottles, the air in the bottles replaced with nitrogen, and the lids of the bottles sealed on with wax. They were then stored at —20° C. until used. At various intervals a sample was removed from storage, the oleoresin dissolved and made up into 4 different known solutions with alcohol. The procedures for preparing the dilutions and subsequently obtaining spectrophotometric data on them were rigidly duplicated for corresponding samples studied on different days.

The 2 oleoresins described above represent 2 extremes in chlorophyll-like pigment content, and thus the set of dilution samples prepared from them covered a wide range of transmittance at 665 mμ. In Equations

TABLE 1

Comparison of methods for measuring color of alcohol extracts of capsicum spices [e]

Sample	Dilution	Selected Ordinate Method			Gentry Method			Lovibond Method						T_{663}	Selected Ordinate Method			Gentry Method			Lovibond Method		
								Feb. 12		Feb. 18		Feb. 25											
		Feb. 12	Feb. 18	Feb. 25	Feb. 12	Feb. 18	Feb. 25	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.		Av.	High	Low	Av.	High	Low	Av.	High	Low
								Observer		Observer		Observer											
								M	M	N	N	M	N										
A	1	28.0	27.7	28.0	27.9	27.3	27.4	32.0	32.0	28.0	29.0	31.0	28.0	41.6	27.9	28.0	27.7	27.5	27.9	27.3	30.0	32.0	28.0
	2	23.3	22.9	23.3	23.6	23.0	23.3	25.5	26.5	22.5	21.5	24.8	24.5	52.6	23.2	23.3	22.9	23.3	23.6	23.0	24.2	26.5	21.5
	3	18.0	18.0	17.9	18.0	17.7	17.8	19.3	19.5	16.5	18.3	18.8	17.5	65.6	18.0	18.0	17.9	17.8	18.0	17.7	18.3	19.5	16.5
	4	12.2	12.2	12.4	12.1	12.0	12.2	12.2	12.0	11.0	12.1	12.5	11.9	80.7	12.3	12.4	12.2	12.1	12.2	12.0	12.0	12.5	11.0
								Feb. 15		Feb. 22		Apr. 3											
		Feb. 15	Feb. 22	Apr. 3	Feb. 15	Feb. 22	Apr. 3	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.										
								Observer		Observer		Observer											
								M	N	N	N	N	N										
B	1	32.0	32.0	32.4	32.4	32.1	32.1	32.0	29.5	31.0	30.5	26.5	30.5	94.9	32.1	32.4	32.0	32.2	32.4	32.1	30.0	32.0	26.5
	2	26.9	26.7	26.4	26.8	26.5	26.2	27.0	26.0	25.0	24.5	23.0	25.5	96.3	26.7	26.9	26.4	26.5	26.8	26.2	25.2	27.0	23.0
	3	19.9	19.8	19.7	19.8	19.5	19.7	20.5	18.5	18.6	18.5	17.4	18.9	97.4	19.8	19.9	19.7	19.7	19.8	19.5	18.7	20.5	17.4
	4	12.6	12.6	12.7	12.5	12.4	12.5	13.2	11.6	12.0	12.7	11.7	11.9	98.8	12.6	12.7	12.6	12.5	12.5	12.4	12.2	13.2	11.6

[e] To facilitate comparison, all results have been converted to Lovibond red units.

1 and 2, the factor 0.2 (100 — T_{663}) is used to make a correction for red light absorbed by the chlorophyll-like pigments. As has been explained, the factor 0.2 was selected by trial and error and theoretically should fit best those samples with average amounts of transmittance at 663 mμ, and fit worst those samples with either relatively low or relatively high transmittance at 663 mμ. Therefore, the validity of employing the factor 0.2 can be tested by examining those samples in Table 1 with relatively high and relatively low transmittance at 663 mμ.

Results for the 8 dilution samples studied show that in no case was there an average difference greater than 0.4 Lovibond red units between the Selected Ordinate and the Gentry methods. It is also seen that the greatest differences occurred in those samples in a high Lovibond red range where the sensitivity of both methods is lowest. Therefore, these results indicate that the Gentry method (and therefore the use of the factor 0.2) is suitable for measuring color of samples with a wide range of transmittance at 663 mμ, or, in other words, with a wide range of chlorophyll-like pigment concentration.

Table 1 illustrates that the Gentry method is almost as accurate as the Selected Ordinate method for measuring the color of alcohol extracts of capsicum spices. This table also illustrates the superiority of the Gentry method over the Lovibond method. It will be noticed that 2 observers were used for the Lovibond method, and their results indicate the differences which can be obtained between observers using the same set of Lovibond glasses, etc. The day-to-day variations which occur within a single observer are also illustrated.

In Table 1, the average values obtained by the Lovibond method are in marked disagreement with the values obtained by the Selected Ordinate method. This is due in part to the fact that 2 observers were used. Observer M was the observer employed throughout this investigation, and it is his results which were used to correlate Gentry units with Lovibond red units, as shown in Figure 3. It is seen in Table 1 that the second observer, Observer N, obtained lower Lovibond red values than did Observer M. However, this was not the only reason for the discrepancies between the 2 methods. Many of the values obtained by Observer M are, by themselves, much higher than those obtained by the Selected Ordinate method. This is particularly so for those samples with relatively low transmittance at 663 mμ. Apparently Observer M was relatively insensitive to light transmitted in this region.

It will be noted, in Table 1, that for Sample A, half of the Lovibond determinations were made by Observer M and half by Observer N, while for Sample B, most of the readings were made by Observer N. Originally, Observer M was scheduled to read Sample B on February 28, but at that time he became unavailable and, therefore, Observer N was employed instead.

Spectral transmission curves for various alcohol extracts of capsicum spices and Lovibond-glass combinations are shown in Figure 4. The curves have not been extended beyond 663 mμ because this is the longest wavelength employed in the Thirty Selected Ordinate Method *(2)*. In this figure, it can be seen that 2 extract samples have a Lovibond red value of 14, although their spectral transmission properties are not identical. The sample represented by X's has less transmittance at 569 mμ and hence a higher carotenoid concentration than the sample represented by circles. However, the former also has less transmittance at 663 mμ and hence a higher chlorophyll-like pigment concentration. Since the chlorophyll-like pigments subtract from the red

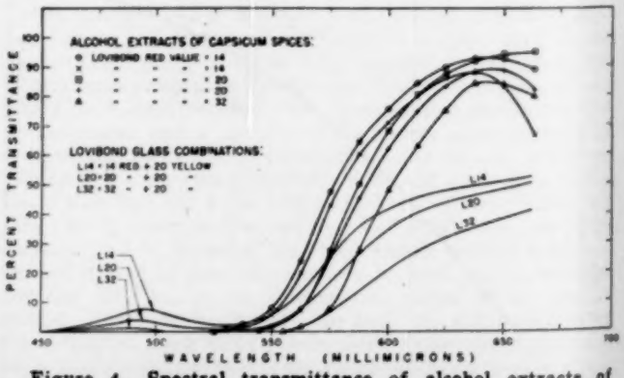

Figure 4. Spectral transmittance of alcohol extracts of capsicum spices and of Lovibond glass combinations. The data for the Lovibond glass combinations were calculated from the data of Gibson, Harris and Priest, obtained on a set of glasses, designated as B. S. 9940 (1).

color, their presence counter-balances the additional red color due to a higher carotenoid concentration. Thus it is possible for samples having different spectral transmission characteristics to have the same Lovibond-red value. Another illustration of this point is seen with the 2 samples having Lovibond-red values of 20.

In Figure 4, the differences between the spectral transmission curves of the extracts and the Lovibond glasses are quite apparent. When a match is made in the Lovibond method, theoretically the same ratio of red and green light, as interpreted by the observer, is transmitted by both the extract and the glasses. If the observer's ratio of sensitivity to these two stimuli changes, the match will no longer exist, because of the differences in the spectral transmission curves. A rematch can be made only if a different combination of Lovibond glasses is used. This is probably one of the main reasons why variations within and between individual observers are a major source of error in the Lovibond method.

Other sources of error in the Lovibond method not mentioned in the above discussion are: 1. No standard testing of observers is in operation in the range of Lovibond red covered by the method heretofore used for capsicum spices; 2. The illuminant used (100-watt blue-frosted Mazda bulb) is not standardized; 3. Lovibond 20-yellow glasses are generally not standardized. This will probably not be a serious source of error because, comparatively speaking, the yellow glass is not as important as the red glasses. In addition, the method is limited by the fact that loose Lovibond glasses are difficult to obtain *(8)*.

A possible criticism of the Gentry method is that it measures transmittance on a very steep slope of a transmission curve. Thus, if errors in the calibration of the wavelength or photometric scales of the spectrophotometer occur, or if errors are made in the wavelength settings in the Gentry method, significant errors also can be introduced into the final results. To increase the universal accuracy of the Gentry method, it is suggested that the spectrophotometer used be calibrated against a transmission standard each time the method is used. This can be done conveniently by placing standard glass discs in the filter slide provided in the Beckman Model DU Spectrophotometer.

GENTRY METHOD

Scope. The method measures the color of alcohol extracts of capsicum spices. Where the amounts of spice and solvent used are not specified, 0.1 g. of ground spice and 50 ml. of 95% ethyl alcohol, or equivalent ratios are assumed. The method covers a range of samples corresponding to 11 to 36 red units in the Lovibond system.

Apparatus. *Spectrophotometer.* A Beckman Model DU Spectrophotometer is recommended. The wavelength and the photometric scales should be checked. For instructions on this procedure, see reference *(4)*.

Matched 10-cm. cells and corresponding cell holder and compartment. The cells should be matched at 569, 577.5, and 663 mμ, when both the cells contain solvent. Such matched cells are readily available. Differences in their transmittance can be tolerated if appropriate corrections are applied. The cells, of course, should be kept clean and free from scratches.

Procedure. 1. Fill one cell with 95% alcohol. Fill the other cell with the filtered extract of the capsicum spice.

2. Place both cells in the cell holder and this in the cell compartment. Place cover on cell compartment.

3. Adjust slit width to 0.04 mm. With the ultraviolet-sensitive phototube in position, zero the dark current. Set the wavelength at 569 mμ, approaching the setting from the same direction used when the wavelength scale of the spectrophotometer was checked (see "Apparatus," above). Zero the meter needle by means of the sensitivity knob. Set the selector switch on "check" and place the sample cell in the light path. Adjust the transmission dial until the meter needle reads zero. Record the percent transmission value obtained. Re-set the wavelength at 569 mμ and repeat the above procedure. Use an average of the 2 readings for the final value.

4. If the value obtained under Procedure 3 is 20.0% or above, proceed to Step 5. If not, disregard the value at 569 mμ and repeat Procedure 3, using a wavelength setting of 577.5 mμ instead of 569 mμ.

5. Close shutter switch. With the red-sensitive phototube in position, determine percent transmittance at 663 mμ in the manner described in Procedure 3.

6. Apply the values obtained in Procedure 3, 4, and 5, to either Equation 1 or Equation 2:

Equation 1:

$$\text{Gentry units} = T_{569} + 0.2\,(100 - T_{663})$$

Equation 2:

$$\text{Gentry units} = T_{577.5} + 0.2\,(100 - T_{663}) - 14.2$$

where,

T_{569}, $T_{577.5}$, T_{663} = percent transmittance at 569, 577.5, and 663 mμ, respectively.

7. If Lovibond red values (as used in combination with a 20-yellow) are desired, they may be obtained directly from Gentry units by using Figure 3.

SUMMARY

A method has been developed for measuring the color of alcohol extracts of capsicum spices in terms of Gentry units. This method involves transmittance at 2 wavelengths determined with the Beckman Model DU Spectrophotometer, using 10-cm. sample cells, and it has been found to be more accurate than the heretofore-used method employing Lovibond glasses. In addition, the method embraces the advantages associated with an objective method; that is, it is permanent, universal, and not vulnerable to the usual errors of subjective methods.

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Nutritive Value of Canned Foods. No. XLIV. Enzyme Inactivation and Ascorbic Acid Retention in Vegetables Blanched and Held Under Different Conditions Prior to Canning[a]

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Data on the effects of high and low temperature blanching and various treatments after blanching on the retention of ascorbic acid and inactivation of enzymes are reported for asparagus, peas, green beans, spinach, and lima beans. The relationship between enzyme inactivation and ascorbic acid content was found to have no clear-cut pattern but some interesting associations between the enzyme and ascorbic acid data are noted.

One of the procedures in the commercial canning of vegetables is blanching or scalding of the produce before it is filled into the can. It is recognized that during this process some loss of nutritive value occurs, especially of nutrients such as vitamins which are easily oxidized and/or soluble in water. This paper is concerned with the effects of different blanching and holding technics on the ascorbic acid content and enzymatic activity in a number of vegetables. The conditions and times of holding were representative of those encountered inadvertently by commercial canners in regular daily runs or at times of mechanical difficulties.

A number of papers have been published on the effect of different times, temperatures, and methods of blanching on the ascorbic acid content of canned vegetables *(2, 3, 4, 5, 6, 7, 8, 13, 14, 15)*. There is general agreement that prolonged blanching time increases the loss of ascorbic acid, especially at high temperatures. If the blanching temperature is low, short blanching times also increase the ascorbic acid losses of certain vegetables. It is considered that short times at low temperatures are not sufficient for enzyme inactivation, leading to increased loss of ascorbic acid by oxidation, while prolonged times increase the loss by solution. In general, short-time, high-temperature blanching gave better retention of ascorbic acid.

Adams *(1)* reported that holding peas, green beans and lima beans after blanching increased the ascorbic acid loss. Lamb *(8)* reported the same trend for green beans.

METHODS

The vegetables studied included asparagus, peas, green beans, spinach and lima beans. The first three were tested during the summer of 1948, the other two during the summer of 1949.

Harvesting. Harvesting details for the various vegetables are listed in Table 1.

Processing. The times and temperatures for blanching the vegetables are listed in Table 2. After blanching, each lot of vegetables was divided into 7 sub-lots. These sub-lots were treated as outlined in the figures.

The vegetables were blanched by placing in perforated baskets and immersing in water heated with live steam. The ratio of blanch water to vegetable was approximately ten to one. The vegetables for sub-lot 1 were drained and filled into the cans immediately. The other sub-lots were drained and transferred to buckets containing water of the temperature indicated in the figures. Sub-lots 2 and 5 were stirred briefly, drained and canned. Sub-lot 3 was held for 30 minutes in water, drained and canned. Sub-lots 4, 6 and 7 were stirred, then drained and held by turning into lugs with perforated bottoms. The ratio of rinse water to vegetable was approximately five to one.

Samples for enzyme, ascorbic acid and moisture determinations were taken from the fresh vegetables and from each sub-lot after the various blanching and holding treatments. The canned

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TABLE 1
Harvesting conditions

Vegetable	Date	Weather	Condition of raw product	Temperature of raw product	Comments
Asparagus	May 25	clear, cool	very good	58° F.	
	May 27	clear, warm	very good	78° F.	
Peas,					
Thomas Laxton	June 29	cloudy, high humidity, rain night before	good		
Canner King	July 3	clear and hot, rain night before	very good		some evidence of nutritional deficiency in growth of plants
	July 8	clear, hot	slight over-mature		
Green beans, stringless green pod	August 11	clear, bright, rain night before	small to rather large pods, few rust spots	81° F. before, 68° F. after washing	
	August 19	clear, hot	large, well-filled pods, to slightly immature ones	73° F. after washing	Motor failure at factory delayed processing 3 hours.
Spinach	June 10 and 11	clear, moderate, very dry	very good	74° F.	muck-grown
Lima beans	Sept. 19	clear, cool, rain the day before	from viner-bruised, dirty, somewhat broken	60° F. before washing	Required extensive sorting
	Sept. 20	clear, light rain the night before	better condition than on Sept. 19—fewer broken beans		Less sorting required

TABLE 2

Blanching times and temperatures for vegetables

Vegetable	Run	Blanching time and temperature	
		High temperature blanch	Low temperature blanch
Asparagus	5/25/48	208° F., 1½ min.	180° F., 5 min. 10 sec.
	5/27/48	208° F., 2½ min.	180° F., 3 min.
Peas	6/29/48	200° F., 2 min.	170° F., 2 min.
	7/3/48	200° F., 2 min.	170° F., 2 min.
	7/8/48	202° F., 2 min.	170° F., 2 min.
Green Beans	8/11/48	200° F., 2 min.	170° F., 2 min.
	8/19/48	200° F., 2 min.	170° F., 2 min.
Spinach	6/10/49	170° F., 4 min. plus 212° F., 3 min.[a]	170° F., 2 min. plus 212° F., 1½ min.[a]
	6/11/49	170° F., 4 min. plus 212° F., 3 min.[a]	170° F., 2 min. plus 212° F., 1½ min.[a]
Lima Beans	9/19/49	200° F., 3 min.	170° F., 2 min.
	9/20/49	200° F., 4 min.	170° F., 2 min.

[a] The first water was approximately 185° F. (85° C.) when the spinach was added. This addition cooled the water to 170° F. (76.7° C.), which temperature was maintained for the time indicated. The second water was 212° F. (100° C.) when the spinach was added. The temperature dropped to 206° F. (96.7° C.) and then increased, but did not reach 212° F. (100° C.) within the time indicated.

vegetables were sampled for ascorbic acid and moisture after one month of storage. Ascorbic acid determinations[c] were made by the Loeffler and Ponting method *(9)*. Samples for moisture determinations were dried at 120° F. for 2½ to 3½ hours in a semi-automatic moisture tester.[d] Catalase determinations were made according to the method given by Thomas *(12)*, and peroxidase by the indophenol titration method of Lucas and Bailey *(10)*. Determination of ascorbic acid oxidase was attempted but the method was not suitable for the purpose of this study. Statistical calculations were made according to methods given by Snedecor *(11)*.

The ascorbic acid data are expressed on the wet basis. In the canned samples, the solids and liquid were separated by draining the can contents for five minutes in a colander. Ascorbic acid and total solids determinations were done on these separate portions, then the data calculated back to the total can contents by using the weight of each portion.

RESULTS

Asparagus. The low temperature blanch made it somewhat difficult to attain the same fill-in weight in the cans as was obtained with the high temperature blanch.

The percent inactivation of catalase and the ascorbic acid content are shown in Figure 1.

The catalase assays showed a slightly higher inactivation following the low temperature blanch than resulted from the high temperature blanch. However, either blanch was sufficient to inactivate all or nearly all of the catalase in 23 of the 27 samples. Inactivation tended to be higher for all treatments in the first run than in the second run. There was evidence of slight recovery of catalase activity between the 15-minute and 30-minute holding periods following the 180° F. (82.2° C.) rinse.

The greatest differences in ascorbic acid content of the asparagus before canning were caused by the various holding treatments after blanching, with the samples canned immediately being highest and those held in water lowest. However, these differences did not show up when the data were calculated on the dry basis, indicating that the shift was in total solids rather than in

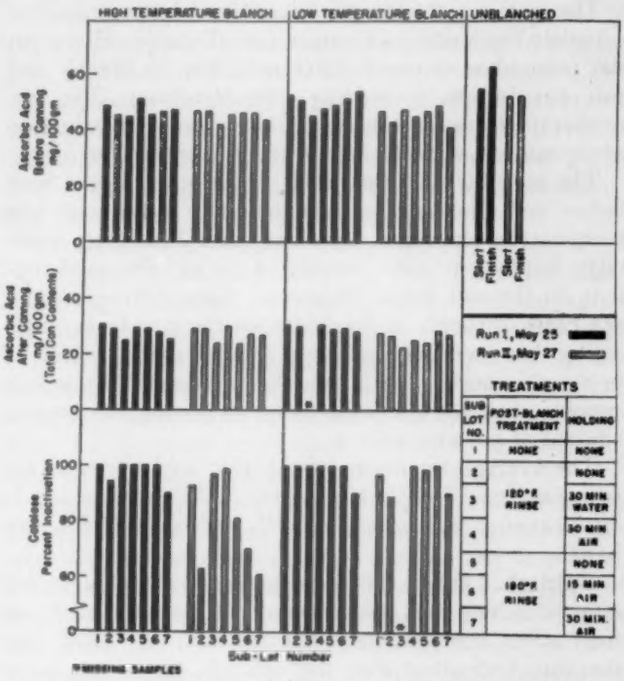

Figure 1. Ascorbic acid content and catalase inactivation in asparagus.

ascorbic acid alone. This also held in the canned samples, for both the treatments after blanch and the difference between runs.

The average ascorbic acid retentions in the asparagus were— a, *following blanching and holding:* 84.7% wet basis, 74.4% dry basis; b, *after canning and storage:* 49.7% wet basis, 64.5% dry basis.

Green beans. The percent inactivation for catalase and peroxidase and the ascorbic acid contents are illustrated in Figure 2.

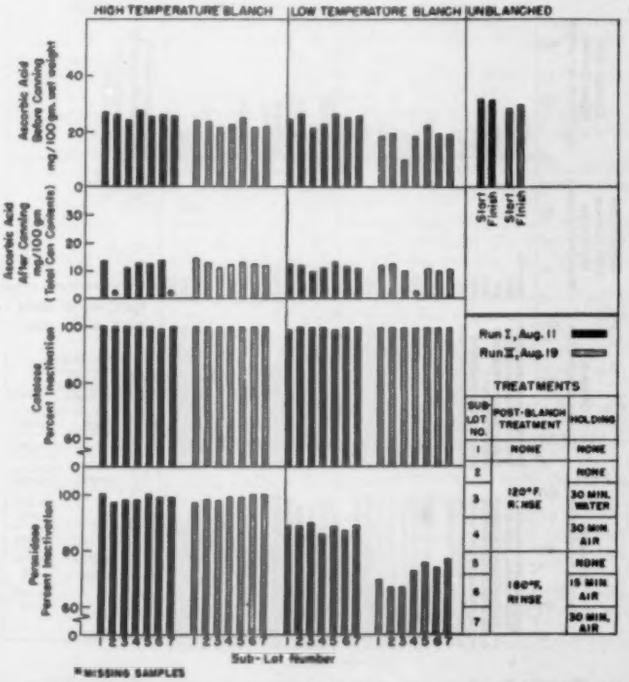

Figure 2. Ascorbic acid content and enzyme inactivation in green beans.

[c] We gratefully acknowledge the assistance of the research staff of the Foods and Nutrition Department in performing the ascorbic acid and moisture determinations.

[d] Brabender Semi-automatic Moisture Tester, Brabender Corp., Rochelle Park, N. J.

The various treatments caused nearly complete or complete inactivation of catalase in all cases. However, the peroxidase showed differences due to blanch and run, but not due to holding after blanching. The low temperature blanch caused definitely lower inactivation of peroxidase, with the second run lower than the first.

The ascorbic acid retention in the green beans both before and after canning was definitely lower with low temperature blanching. Holding after blanching, especially holding in water, decreased the ascorbic acid content on the wet basis. However, these differences did not carry through as markedly on the dry basis, indicating that there were changes in total solids as well as in ascorbic acid. The 2 runs differed materially before canning, but not after, the first run having the greater amount of ascorbic acid.

The average retentions of ascorbic acid were—a, *before canning:* 75.7% wet basis, 71.7% dry basis; b, *after canning and storage:* 39.7% wet basis, 57.5% dry basis.

Spinach. When the spinach was thoroughly cooled after blanching, less spinach could be placed in each can than when comparatively hot spinach was filled into the can, indicating that the spinach picked up some water during cooling.

The data on enzyme inactivation and ascorbic acid content for the spinach samples are given in Figure 3.

The high temperature blanch resulted in nearly complete or complete inactivation of catalase and peroxidase in all but one case, the catalase in the sample rinsed at 120° F. (49° C.) and held for 30 minutes in air.

The low temperature blanch gave less than complete inactivation of both catalase and peroxidase in a number of cases. There were no clear cut differences due to treatment after blanching, although the samples rinsed in 180° F. (82.2° C.) water showed a slight trend toward increased activity with increased holding in air

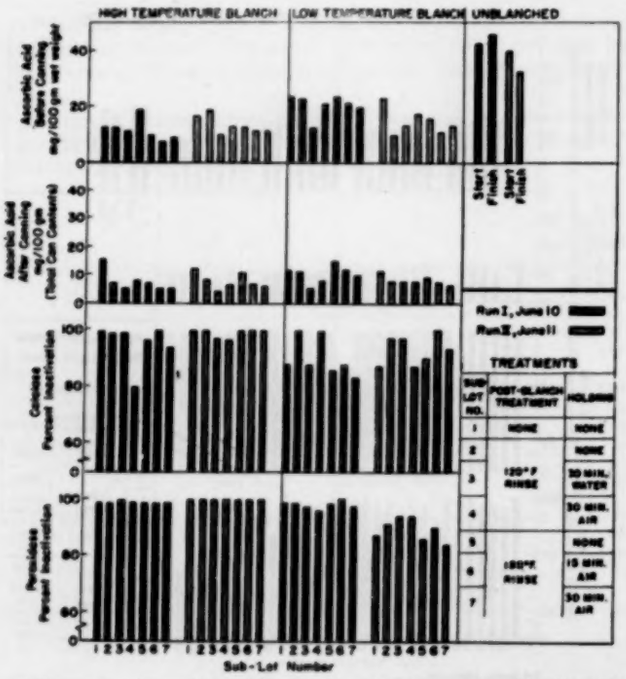

Figure 3. Ascorbic acid content and enzyme inactivation in spinach.

from 15 to 30 minutes. The inactivation of peroxidase with low temperature blanching was lower in the second run than in the first. The low temperature blanch gave better retention of ascorbic acid in the spinach. Lamb *(8)* has indicated that blanches in excess of 5 minutes have an unfavorable effect on the retention of ascorbic acid in spinach.

The ascorbic acid content tended to be highest in the samples canned immediately after blanching. In most cases, rinsing decreased the ascorbic acid, and holding after rinsing, especially holding in water, caused further decreases.

The average ascorbic acid retentions in spinach were —a, *before canning:* 38.7% wet basic, 28.6% dry basis; b, *after canning and storage:* 21.0% wet basis, 17.3% dry basis.

Lima beans. The lima bean data are shown in Figure 4.

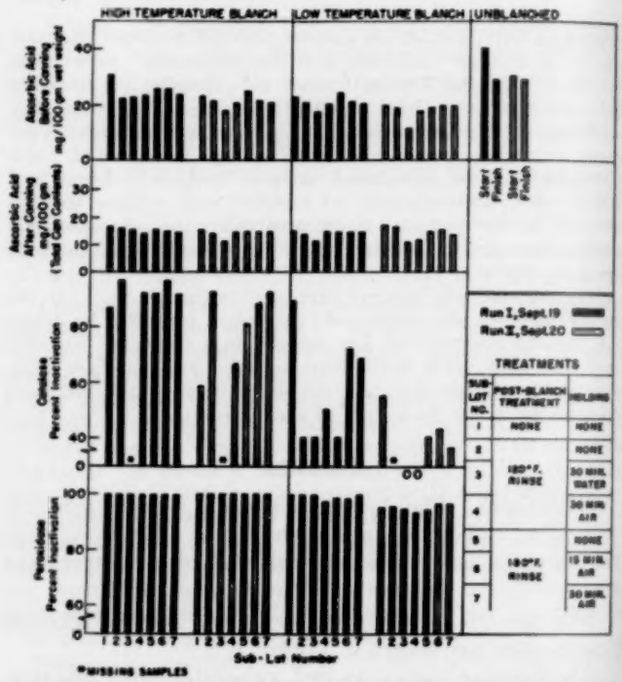

Figure 4. Ascorbic acid content and enzyme inactivation in lima beans.

The enzyme inactivation data indicate that the peroxidase was nearly or completely inactivated by all treatments. However, a large number of samples showed appreciable catalase activity. This activity was greater in the low temperature blanch than in the high temperature blanch, and greater in the second run than in the first.

The high temperature blanch gave superior ascorbic acid retentions over the low temperature blanch. The samples canned immediately after blanching usually had the highest ascorbic acid content, with rinsing decreasing the amount slightly and holding after rinsing causing further decrease. The two runs were quite similar in ascorbic acid content.

The average ascorbic acid retentions in the lima beans were—a, *before canning:* 62.8% wet basis, 62.3% dry basis; b, *after canning and storage:* 44.6% wet basis, 63.8% dry basis.

Peas. Figure 5 shows the results obtained with peas. With one exception all the enzyme inactivations were 90% or greater. Therefore, the differences in degree of inactivation were not considered significant. The enzyme data on the first run (Thomas Laxton) were incomplete, due to methodological difficulties.

The ascorbic acid content of the peas differed materially due to run and to treatments after blanching. The ascorbic acid decreased with holding between blanching and canning, especially with holding in water. The differences in ascorbic acid due to run were probably varietal, as the two runs of Canner King were quite similar, with the Thomas Laxton much lower.

The average retentions of ascorbic acid were—a, *before canning:* 68.5% wet basis, 66.8% dry basis; b, *after canning and storage:* 45.7% wet basis, 57.3% dry basis.

SUMMARY

A comparison has been made of the effects of high and low temperature blanching, and of various treatments after blanching, on the inactivation of catalase and peroxidase, and on the ascorbic acid content of asparagus, peas, green beans, spinach and lima beans.

The average ascorbic acid contents following blanching were comparable with those found by other workers, with the possible exception of spinach where the retentions were quite low. These low retentions may have been due to the use of muck-grown spinach, and to the extensive contact with water in the blanching method used. The retentions in the canned products were rather low in comparison to other published data. The higher retention values obtained on the dry basis for all the canned vegetables except spinach, indicated that part of the apparent loss during canning was due to dilution of the vegetables by the addition of water to the can, not to destruction of ascorbic acid.

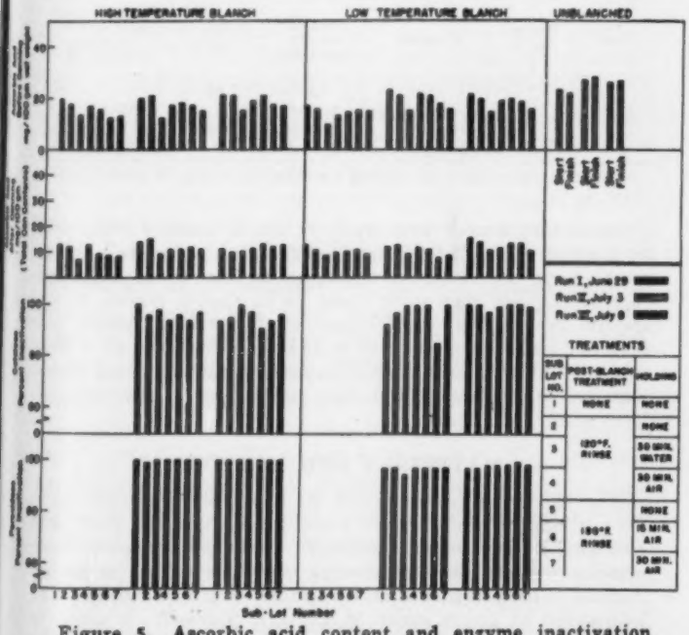

Figure 5. Ascorbic acid content and enzyme inactivation in peas.

Blanch. The low temperature blanch was superior to the high temperature for catalase inactivation in asparagus and for ascorbic acid retention in spinach. The high temperature blanch gave better results than the low temperature for catalase inactivation in spinach and lima beans, for peroxidase inactivation in spinach and green beans, and for ascorbic acid retention in green beans and lima beans.

Treatment after blanch. There was no definite trend of change in enzyme activity with treatment after blanching. Canning immediately after blanching gave the highest ascorbic acid retentions, while rinsing and/or holding after blanching generally decreased the ascorbic acid content. This was especially marked in the samples held in water 30 minutes. In some cases, however, the decrease was caused in part by a change in total solids rather than in ascorbic acid alone.

Relationship between enzyme inactivation and ascorbic acid content. There was no clear cut pattern or relationship between the enzyme and ascorbic acid data. Lowered peroxidase inactivation was associated with lowered ascorbic acid content for the green beans, when comparing the effect of blanching. This was also true for catalase inactivation and ascorbic acid content of lima beans. However, the enzyme figures and ascorbic acid data showed opposite trends toward blanching in the spinach. There was some indication of similar trend in peroxidase inactivation and ascorbic acid content due to difference between runs in green beans and spinach.

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Sugar and Acid Tolerance of Spoilage Yeasts from Sweet-Cucumber Pickles[a]

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What is believed to be the first preservation-prediction chart for yeast spoilage in sweet-cucumber pickles has been developed through studies of 35 yeast cultures, responsible for gaseous-type spoilage, which were isolated from 15 samples of sweet pickles made by 3 pickle manufacturers in different locations. The yeasts were identified as being closely related to the species Zygosaccharomyces globiformis. The prediction chart should aid the pickle manufacturers in standardizing sweetening formulas, in reducing spoilage, and in saving sugar.

It is well known that sugars and organic acids play an important role in the preservation of certain food products — especially in the manufacture of sweet-cucumber pickles. Where pasteurization and such chemical agents as sodium benzoate are omitted, the pickle product must contain sufficient quantities of sugar and acid, which are usually cane sugar and vinegar, to preserve it properly.

The methods for sweetening cucumber pickles have been more of an art—handed down from one pickle manufacturer to another — than a science based on knowledge of spoilage organisms of high sugar and high acid tolerance. Fabian and Demain *(4)* reported a wide variation in the amounts of sugar and vinegar that existed among different commercial sweet-pickle products. Manufacturers have raised or lowered the quantities of sugar and vinegar needed usually on a trial and error basis.

Because of this lack of exact formulas to insure preservation, the possibility of microbial spoilage of their products has been a problem to pickle manufacturers. Fabian and Switzer *(5)*, in a paper on the classification of pickles, warned manufacturers of spoilage in sweet pickles which finish below 20 grains of vinegar (2.0% acetic acid). Etchells and Jones *(2)* cited an occurrence of yeast spoilage in the finishing of sweet pickles which they attributed to low acidity, but they were unsuccessful in attempts to isolate the yeast because it was dead at the time of observation.

A number of workers *(1, 6, 10, 12, 16)* have reported on the preserving and germicidal action of sugars and organic acids, but they were in most instances studying yeasts and other organisms which did not have a history of causing spoilage in acid foods such as pickles. One cannot assume, as did Fellers and his co-workers *(10, 12, 16)*, that the "bread yeast" *Saccharomyces cerevisiae* will represent the characteristics of all species of yeasts. Yeast growth occurring in foods other than sweet pickles, such as honey, maple sirup, molasses, and dried fruits, has been thoroughly reviewed by Henrici *(7)* and Mrak and Phaff *(13)*, who showed that species of the genus *Zygosaccharomyces* were most frequently found in high-sugar content substrates.

The present study is believed to be the first in which the yeasts causing spoilage in commercial sweet pickles have been isolated and studied with respect to their acid, sugar, and benzoate tolerances. In this work a sweetening chart for the prediction of preservation or spoilage was developed which is based on the biochemical properties of spoilage yeasts isolated from commercially prepared sweet cucumber pickles. This chart is presented here for the aid it may offer pickle manufacturers in standardizing their sweetening formulas, in reducing spoilage, and in saving sugar.

EXPERIMENTAL PROCEDURE

Isolation and identification of spoilage organisms. In a period of a year 15 samples of spoiled sweet pickles were received by our laboratory from 3 manufacturers in different sections of the country. Spoilage was characterized by slight gaseous pressure under the caps, off-flavor, and lens-type bloaters (hollow cucumbers). Microscopic examination of the liquor showed a high non-viable yeast population compared to a low viable count. The liquors from the jars were either plated or streaked on acidified dextrose-agar media using the technique of Etchells and Jones *(3)*, and from these plates 35 isolates were obtained. Their source as to type of pickle product, sugar and vinegar levels is given in Table 1.

TABLE 1

Origin of 35 yeast cultures from spoiled sweet pickles from 3 commercial pickle plants

Plant	No. of jars	Product	Range in acidity as acetic	Range in sugar	Spoiled pickle yeast (SPY), culture numbers
			%	%	
A	4	Sweet chips	1.5-1.6	23	SPY-1 to 13
B[b]	7	Sweet mix	0.7-0.8	12-16	SPY-14 to 31
C	4	Sweet whole	1.8-1.9	20	SPY-32 to 35

[b] Product contained 0.1% sodium benzoate, according to manufacturer.

Taxonomic studies were made on the 35 isolates which will be referred to as "SPY" for "Spoiled Pickle Yeasts." These yeasts were identified as belonging to the genus *Zygosaccharomyces*, and they were found to be closely related to the species *Z. globiformis* Kroemer et Krumbholz which was described and studied in detail in 1931 by Krumbholz *(9)*. Five cultures (SPY 9, 15, 21, 29, 32) were selected as being representative of the group, and these were used in the tests for fermentation and growth.

MATERIALS AND METHODS

The preserving agents tested for inhibition of growth using the test cultures were sucrose (cane sugar), glucose, acetic acid (vinegar[c]), and sodium benzoate. These are chemical compounds used by the commercial cucumber-pickle companies. Sucrose in the presence of acetic acid and heat was considered as hydrolyzed to invert sugar *(8, 14, 15)*. Similarly, it could be assumed that the sucrose as used by the commercial companies

[a] A cooperative project with the Department of Horticulture of the North Carolina Agricultural Experiment Station.

[c] Distilled vinegar, 110 grains (11.0% acetic acid) was used. Referred to in this paper in terms of percent acetic acid.

for making sweet pickles would also be inverted due to the presence of acetic acid and usually some mild heat treatment. The basal broth used to supply the necessary nutrients for yeast growth consisted of 0.5% Bacto peptone, 0.25% Bacto yeast extract and 0.5% sodium chloride. To the basal broth, sucrose or glucose on a percent by weight basis, and acetic acid as vinegar on a percent by volume basis were used to make the test broths. The concentrations for sucrose were from 2 to 65%, and for glucose from 2 to 40%. Acetic acid concentrations varied from 0 to 4%. Sodium benzoate, in conjunction with sucrose and acetic acid, was also tested in concentrations from 0.05% to 0.4%.

Fermentation tests for the various sugar, acid, and benzoate broths were conducted in Durham tubes, which consisted of a small inverted tube (9 x 75 mm.) inserted into a larger tube (16 x 150 mm). The tubes with broth were sterilized at 15 pounds of pressure for 15 minutes, followed by prompt cooling in water. The inoculated broths were observed frequently for gas and growth; the latter was determined by turbidity and sediment. After 2 to 4 weeks, microscopic counts for viable and non-viable yeast cells were made with an improved Neubauer hemacytometer counting chamber used as described by Mills *(11)*. He reported a sharp distinction between viable and non-viable yeast cells in solutions of methylene blue, methyl green, and erythrosin, using 1: 10,000 concentrations of the dyes in phosphate buffer at pH 4.6. Mills also preferred methylene blue for best results. However, our experience with yeasts in high salt content brines and high sugar content liquors has proved erythrosin to be the most satisfactory for giving a sharp distinction between living and dead cells and ease in counting.

RESULTS

Fermentation and growth tests. In preliminary studies, the test yeasts grew and produced gas in broths containing the basal nutrients and the following ingredients:

Sucrose, 60% (by weight).
Glucose, 40% (by weight).
Sucrose, 2%; acetic acid, 3.6% (at pH 3.0).
Sucrose, 15%; acetic acid, 0.8%; and sodium benzoate, 0.3%.
Sucrose, 10%; acetic acid 1.5%; and sodium benzoate, 0.1%.

In these broths, the yeasts demonstrated unusually high tolerance to the above individual preserving agents. Additional tests were conducted to obtain the exact limitations for growth in various concentrations and combinations of these ingredients.

In one experiment, sucrose was held constant at 10% with the levels of acetic acid increased to approximately 3.5% in increments of 0.5%. The acetic acid levels with pH values in parentheses for the uninoculated broths were as follows: 0% acetic acid (6.52); 0.5% (3.68); 1.0% (3.42); 1.5% (3.28); 2.0% (3.12); 2.5% (3.10); 3.0% (2.96); and 3.6% (2.92). The effect on yeast cell production and gas evolution was very noticeable. The viable and non-viable yeast counts, after 14 days' growth, are illustrated in Figure 1. The non-acid broth gave a population of over 40 million viable yeast cells per ml. with a very low non-viable count. The acidified broths gave a decrease in viable cells as compared to an increase in non-viable cells until the point of inhibition was reached. Yeast populations were rapidly suppressed beyond the 2.5% acetic acid level, and no viable cells were observed at 3.6% acetic acid. Gas from yeast growth filled the insert tubes in all the broths except that at 3.6% acetic acid level, which was

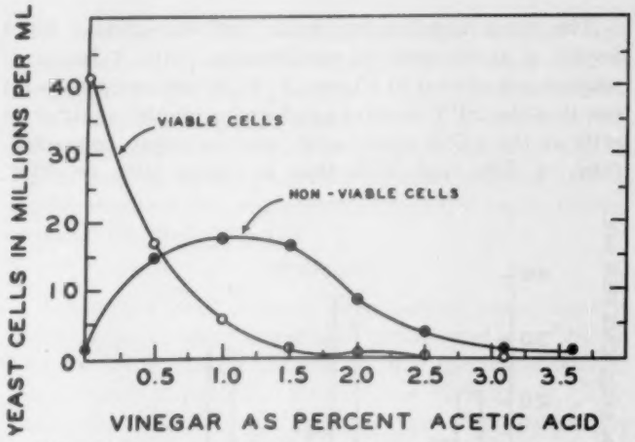

Figure 1. Yeast populations at fourteen days in ten percent sucrose and various concentrations of acetic acid. (Test yeast strain used Spy 29.)

negative. Two days were required to fill the insert tubes for 0 through 1.5% acetic acid; 5 days for 2.0%; 6 days for 2.5%; and 7 days for 3.1%.

The results of other tests are shown in Table 2. Here the concentrations of sucrose and glucose as well as that of acetic acid were varied and the broths inoculated with the representative cultures. With sucrose, growth and gas were observed at all levels of the sugars through 1.5% acid. In 2.0% acid, growth and gas were observed in concentrations through 35% sucrose, but not at 40%. Further inhibition for growth and gas were shown in 2.5% acid; the limitation of growth was between 20% and 30% sugar concentrations. When glucose was substituted for sucrose, a greater inhibition was noticed using the same levels of sugar. For example, 2.0% acid and 30% of each sugar gave growth and gas for sucrose but none for glucose. This finding confirms that of Erickson and Fabian *(1)*, and Tarkow et al. *(16)* that glucose, at concentrations equal to sucrose, is more inhibiting for certain organisms.

TABLE 2
Yeast growth and gas in broths containing sugar and acetic acid

Test broths containing		Sucrose		Glucose	
Acetic acid	Sugar	Growth [d]	Gas [e]	Growth [d]	Gas [e]
%	% by weight				
1.0	10	3+	+ (3)	3+	+ (5)
	20	3+	+ (3)	3+	+ (7)
	30	3+	+ (5)	3+	+ (9)
	40	2+	+ (7)	2+	+ (16)
1.5	10	3+	+ (3)	3+	+ (9)
	20	3+	+ (4)	3+	+ (11)
	30	2+	+ (5)	2+	+ (16)
	40	2+	+ (11)	—	—
	45	1+	+ (28)	....	....
2.0	10	3+	+ (4)	3+	+ (21)
	20	3+	+ (5)	2+	+ (28)
	30	2+	+ (15)	—	—
	35	2+	+ (16)	....	....
	40	—	—	—	—
2.5	10	2+	+ (6)	2+	—
	20	2+	+ (15)	—[f]	—
	30	—	—	—	—
	40	—	—	—	—

[d] Growth: Sediment and turbidity of broth, 3+ = good; 2+ = moderate; 1+ = scant; — = none. Five representative cultures used in this experiment.
[e] Days required for maximum evolution of gas.
[f] One of the five test cultures gave very scant growth. Repeated tests gave same result.

The yeast populations (viable and non-viable) for 4 levels of acetic acid in combination with 4 levels of sucrose are shown in Figure 2. It is important to point out that the SPY isolates produced a greater number of cells at the 1.0% acetic acid level in sugar concentrations of 20% and 30% than at either 10% or 40%.

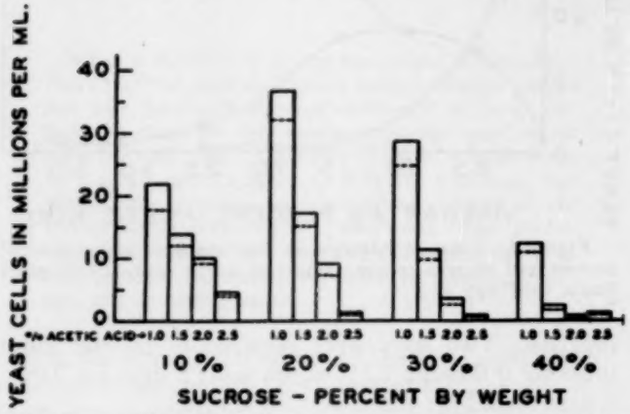

Figure 2. The effect on total yeast populations caused by increasing concentrations of sucrose and acetic acid. The dotted line in each bar represents the non-viable cell count, and above the dotted line the viable count. (Counts made at 28 days using strain Spy 29.)

This is probably due to the osmophilic nature of these yeasts. Further, at 2% sucrose concentration without acid, this group of yeasts assimilates the carbon source for energy but may or may not produce gas. However, acidification of sucrose results in its inversion to simple sugars which are readily fermented by the isolates.

Three concentrations of sodium benzoate were tested in 5 concentrations of acetic acid with 10% sucrose (Table 3). Growth and gas were produced at all 5 levels—0.5% to 2.5% acetic acid at the .05% benzoate level. The 0.10% benzoate inhibited the growth at 2.5% acid, and 0.20% benzoate permitted growth only in the 0.5% acid.

Preservation-prediction lines and formulas. By making additional fermentation and growth tests with various concentrations of the 4 compounds (glucose, sucrose, acetic acid and sodium benzoate), as well as using the tests previously described, certain predictions for preservation seemed possible. In plotting the individual sugar concentrations against the individual acetic acid concentrations, lines were drawn which divide the areas of fermentation and growth from those of no fermentation and no growth. Three lines are presented for the compounds tested[1] which were (A) sucrose and acetic acid, (B) glucose and acetic acid, and (C) sucrose, acetic acid, and 0.1% sodium benzoate (Figure 3). The areas above the lines represent preservation: the areas below, spoilage.

TABLE 3

Yeast growth and gas in 10% sucrose broths containing acetic acid in combination with sodium benzoate

Acetic acid	Concentration of sodium benzoate					
	0.05%		0.10%		0.20%	
	Growth [a]	Gas [b]	Growth [a]	Gas [b]	Growth [a]	Gas [b]
%						
0.5	3+	+ (3)	3+	+ (3)	2+	+ (10)
1.0	3+	+ (3)	2+	+ (5)	−	−
1.5	3+	+ (5)	1+	+ (10)	−	−
2.0	2+	+ (7)	1+	−	−	−
2.5	1+	+ (10)	−	−	−	−

[a] Growth: Sediment and turbidity of broth, 3+ = good; 2+ = moderate; 1+ = scant; − = none.
[b] Days required for maximum evolution of gas.

Commercial test of prediction line. The validity of the prediction line (Figure 3) was substantiated by cooperative tests over a 2-year period by a large pickling company on 37 small-scale commercial lots of sweet-cucumber pickles. The pickles were equalized with sucrose (cane sugar) and acetic acid (distilled vinegar) over a range covering both the preservation and the spoilage sides of the prediction line. Quart samples of each lot were sent to our laboratory and analyses for sugar, acid, and yeast populations were made. When the sugar and acid concentrations of the 37 lots were plotted, 28 were on the spoilage side of the prediction chart and the remaining 9 fell on the preservation side (Figure 4).

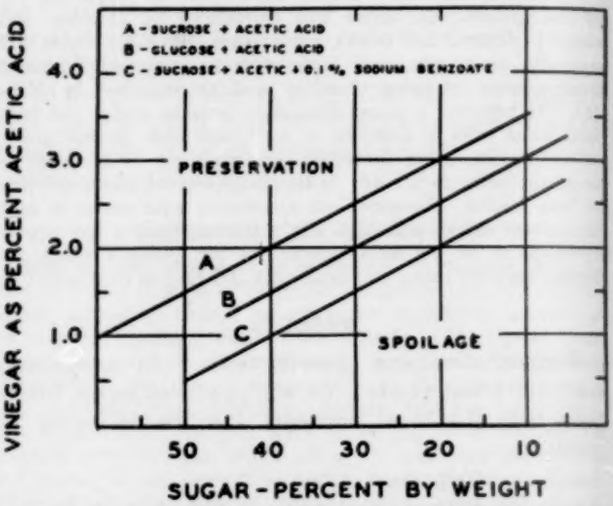

Figure 3. Preservation prediction chart; the area above each line represents preservation for that particular combination of acid, sugar, and/or sodium benzoate; the area below each line represents the spoilage zone.

[1] The following mathematical formulas for the 3 lines can be applied in calculating the quantities of sugar or acid required to prevent fermentation:

(a) Sucrose + Acetic Acid

$$S_s = 80 - (20 \times A)$$

or

$$A = \frac{80 - S_s}{20}$$

(b) Glucose + Acetic Acid

$$S_g = 70 - (20 \times A)$$

or

$$A = \frac{70 - S_g}{20}$$

(c) Sucrose + Acetic Acid + Benzoate

$$S_s + B = 60 - (20 \times A)$$

or

$$A + B = \frac{60 - S_s}{20}$$

Where:

A = % acetic acid
S_s = % sucrose by weight
S_g = % glucose by weight
B = 0.1% Sodium benzoate

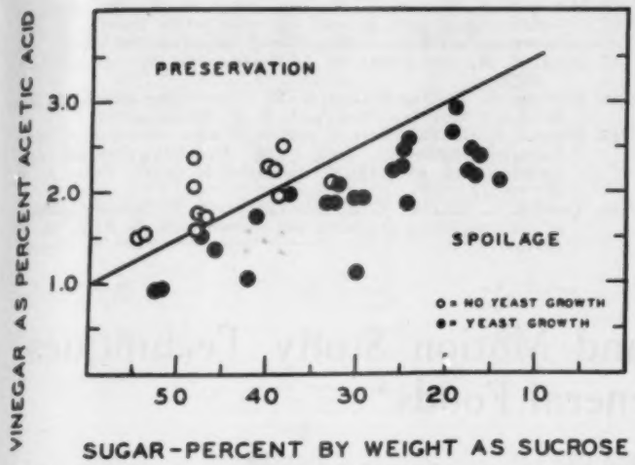

Figure 4. Yeast growth in commercially prepared lots of sweet cucumber pickles at different concentrations of sucrose and acetic acid.

Next, all lots were inoculated with the test yeast to give a final count of about 5,000 viable cells per ml. If, after 3 to 6 weeks from inoculation, there were no viable yeast cells, and the non-viable count had not increased, then the lot was considered preserved. On the other hand, if the total count of either viable or non-viable cells increased, then the pickles had supported growth and were considered spoiled. Most of the lots which were predicted to spoil were either fermenting or had fermented prior to reaching the laboratory.

All 9 lots which were predicted to be preserved were found to be negative for yeast growth and obeyed the sugar-acid prediction formula. Twenty-five of the 28 below the line supported yeast growth and followed through to spoilage as predicted. The authors have no explanation for the 3 lots that did not support yeast growth other than that they were border-line cases.

Ten of the 20 lots made in 1949 were prepared from partly cured salt-stock. It had been the opinion of the manager of the cooperating pickle plant that these lots would be more difficult to preserve and probably take more sugar and acid. However, this was not found to be the case.

DISCUSSION

The isolation of the 35 yeasts from spoiled sweet-cucumber pickles not only helped explain the gaseous-type of spoilage for this product but also gave the opportunity to study the underlying principles of preservation by sugar and acid that have been long used in the art of making sweet pickles. The data obtained, in offering sweetening formulas by which ratios of glucose or sucrose with acetic acid may be determined for the preservation of pickles, should prove to be a useful working tool in processing plants. It should be emphasized, however, that the preservation-prediction lines now being proposed were made from one group of yeasts isolated from products manufactured in 3 sections of the country, and are valid only until such time as other organisms definitely associated with pickle spoilage are shown to be more sugar-and acid-tolerant. The chances of finding additional strains of *Z. globiformis* or other organisms of higher sugar tolerances than the strains studied by the authors should not be ruled out.

It is believed that research workers in other food laboratories may use the representative yeast isolates mentioned in the report in tests of other food products.[1] It is likely that there are many other food preservatives, including additional sugars and organic acids as well as spices and essential oils, which should be tested against highly resistant test organisms such as the yeast cultures used in this study.

SUMMARY

Thirty-five yeast cultures were isolated from commercially prepared sweet-cucumber pickles and were identified as being closely related to the species, *Zygosaccharomyces globiformis* Kroemer et Krumbholz. This yeast was responsible for gaseous type of spoilage in the pickle products examined.

Representative yeast isolates were tested for growth and gas formation in various concentrations of sucrose or glucose with acetic acid. The effect of sodium benzoate was also tested in combination with sucrose and acetic acid. By plotting the sugar and acid concentrations required to inhibit yeast growth, preservation-prediction lines were made. In laboratory tests with the yeast, it took less glucose than sucrose on a percent by weight basis to inhibit growth. The addition of sodium benzoate reduced the amount of sucrose required for preservation.

The validity of the prediction line was substantiated with commercially prepared lots. Thirty-seven small-scale lots of sweet pickles were made by a commercial pickle company so that the sucrose and acid contents after equilibrium ranged on both sides of the preservation prediction line. All lots which were predicted to be preserved did not support yeast growth. Twenty-five lots out of the 28 predicted to spoil were found to have yeast growth.

The preservation-prediction lines should help the pickle manufacturers in standardizing their sweetening formulas, in reducing spoilage, and in saving sugar.

Acknowledgments

The authors gratefully acknowledge the help given by the Brown-Miller Company, New Orleans, Louisiana, and especially the cooperation of Mr. F. O. Brown and Mr. John A. Miller, President and General Manager respectively of the Company, and Mr. George A. Klumb, Manager of the Texarkana Plant. Mr. Klumb was responsible for preparing the various lots of sweet pickles used in testing the Preservation-Prediction Chart.

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Practical Application of Time and Motion Study Techniques as Used in General Foods[a]

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(Manuscript received July 1, 1952)

In our shop, the term, *work measurement*, signifies the techniques used in measuring work, and the methods used in documenting how the work was performed when measured. The application of time and motion study—in our language, work measurement, does no more than produce information. That information will not solve any problem, but intelligently used it may make it possible to reduce manufacturing costs—the ultimate aim of the industrial engineer.

To insure the greatest use of this information, it must be a, accurate, b, tabulated in a way to make it useable, c, in a form that provides a measure of the various elements that make up the total job—not be just a measure of the total job.

Job improvements that effect cost reduction are normally the result of one or more of the following significant changes:

1. Elimination of some element or part of the total job, thus shortening the cycle.
2. Rearrangement of the sequence in which various elements or parts of the job had been performed.
3. Combining of two or more elements in order to reduce the total amount of work required to produce the end result.
4. Simplification of methods used in performing the necessary parts of the job cycle.

Therefore, it is imperative that data developed by time and motion study be documented in a way that can be used in analyzing the individual parts of the job or process.

Recently one of our plants completed a thorough industrial engineering study of one of their processes. This operation is relatively new—an important point to keep in mind since we all know that new processes, new machinery, and an inexperienced work force require a "breaking-in period." During that period, production is low, spoilage is high, crews are overmanned, tempers are short, and costs are long. When this study was inaugurated, the process had gone through the early stages of its breaking-in period. The equipment was operating smoothly, quality was good and spoilage well under control. However, costs were high and production had not yet reached the expected maximum.

THE PROBLEM

The example chosen is a typical General Foods packaging operation. A dry product is mixed and packaged on three parallel packing lines, employing approximately 48 persons on a 3-shift basis.

Figure 1 is a schematic diagram of the process. The mixing operation is demonstrated by the 3 funnel shapes across the top of the screen. The lines are identical. Wax paper is fed into the inner package maker. Blanked chip board is fed into the outer package maker. The 2 package makers operate together automatically, sending packages ready to be filled to the scale which automatically accepts these packages, fills them with the dry ingredient and passes them on to the package closer machine. The packages continue through the wrapper. They are first handled as individual packages by the case packer who places them in the corrugated shipping case and sends them on through the case sealer. From the case sealer they are automatically conveyed to the warehouse or shipping department.

Figure 2 represents the organization as it was found when work measurement was applied to the operation. Each circle represents one individual; the dark portion of the circle indicates the percent of time that individual is occupied on his job. There is no question that the person is at his job position during the working period of the day, but his activity level—controlled in this case by job requirements—is well below normal expectancy for this work. It is obvious that the available manpower is not being fully utilized.

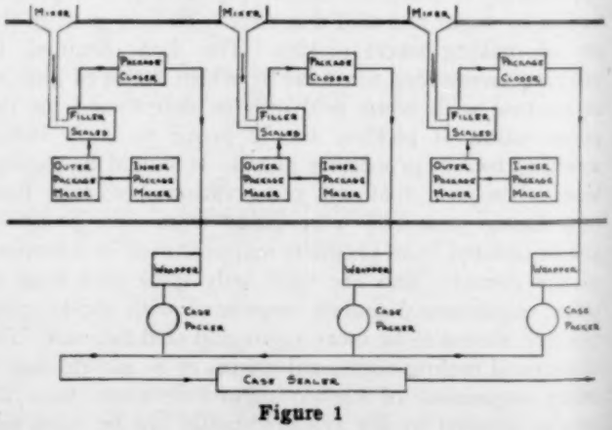

Figure 1

[a] Presented at the Twelfth Annual Meeting of the IFT, Grand Rapids, Mich., June 9, 1952.

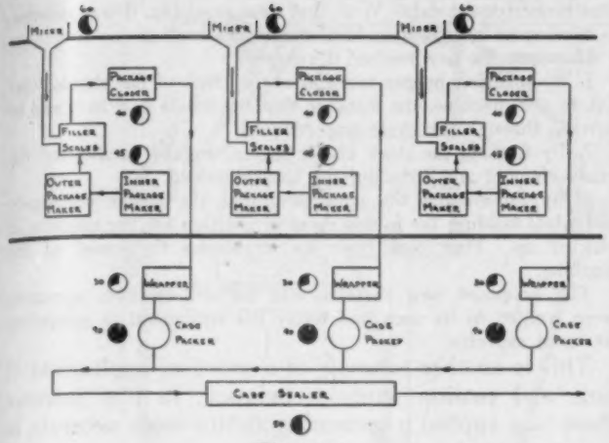

Figure 2

It should be made clear that work measurement information is non-personal. The figures represented on these circles are the total job elements which the person indicated is currently assigned. Work measurement information permits redistributing these elements and adding them up in any combination physically practical. It is this potential for redistributing work elements that makes the information valuable. Time and motion study data which cannot be redistributed, independent of the individuals performing the operation at the time of the study, are of little value for our purposes.

SOLVING THE PROBLEM

Figure 3 shows the potential organization change indicated by the work measurement information. The dark disks represent original manpower assignments; the cross-hatched disks depict proposed assignments. First, the mixer operators are replaced man for man by the cross-hatched disks, indicating that it is not possible to reassign work in this area and utilize the indicated available manpower. When we come to the packaging operation, we find that the greater number of people give us great flexibility and we are able to make a substantial reduction in this area. The dark disks signify that one man was assigned to operating each of the inner and outer package maker machines. Reassignment indicated that one man could be responsible for all machines on each of the 3 lines, *provided he was given some assistance during his peak trouble period.* This assistance took the form of a *recommended head operator*

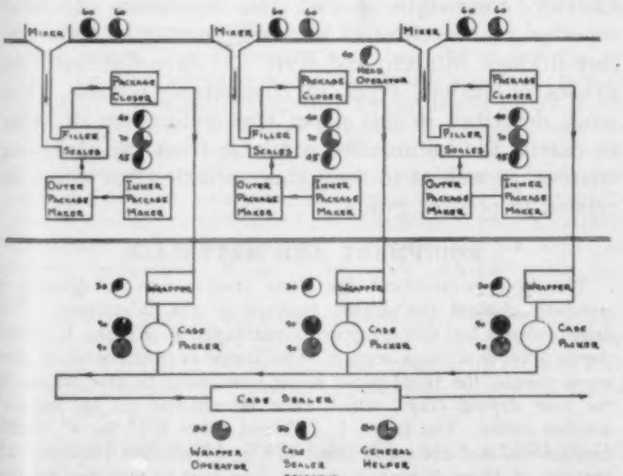

Figure 3

responsible for the total production of the 3 lines. This man is denoted by the cross-hatched disk which indicates a relatively low work load over a long period of time but entails heavy peak work loads assisting the line operators.

This same situation appears in the wrapping and case packing area. Here the previous organization had assigned one man to each wrapping machine. Our studies indicated that one wrapper operator could take care of all these machines, providing some general help was available. Actually, general help had been providing some assistance in supplying materials for line operators. The case packers themselves were indicated at a high work load, and obviously no change could be made on their jobs.

Figure 4 shows the same schematic diagram with the cross-hatched disks indicating current organization and the individual work loads denoted by the percentage figure.

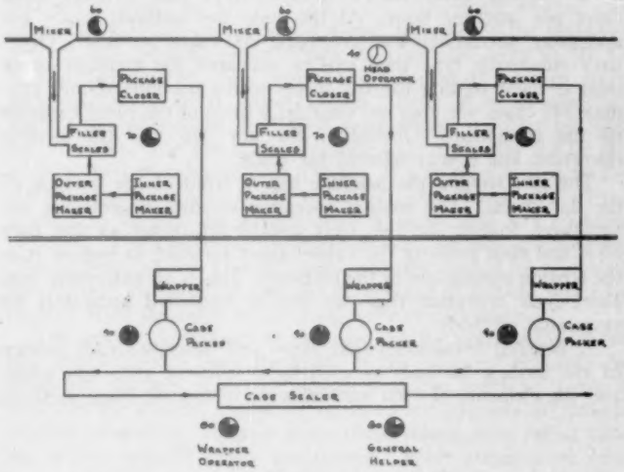

Figure 4

A SECOND TYPE OF PROBLEM

In another plant, where incentives are not used, a recent industrial engineering study produced interesting results. This process, unlike the preceding, had been in operation for several years, during which, work assignments had remained constant. Numerous time studies had been made, and it was known that work loads in many places were low. There appeared to be no easy solution, and—since there was little interest in the matter—no real action had been taken.

Came a new day when several changes were made in the organization and someone started questioning costs—someone who refused to be content with anything less than factual information. The net result was that the work measurement data were carefully audited and low work assignments selected for study. As a result, method changes were developed and installed, job combinations were effected, and minor rearrangements in layout were made. The result was a reduction of slightly over 10% in cost.

These 2 examples of the application of time and motion study have both shown a substantial reduction in crew size with little change in production rates. The impression should not be left, however, that reducing the number of people assigned to an operation is the all-important objective. *It is more important in most instances to increase the productivity of a piece of equipment, than it is to reduce the number of people who work on that equipment.*

A FINAL EXAMPLE

The last example is intended to illustrate that point and also to demonstrate the application of a technique now commonly called Methods Time Measurement.

Maynard, Stegemerten and Schwab[1] have defined *methods time measurement* as "A procedure which can be used to analyze any manual operation or method into the basic motions required to perform it and assign to each motion a predetermined time standard—which is determined by the nature of the motion, and the conditions under which it is made." The authors further state that methods time measurement is basically a tool of methods analysis that gives answers in terms of time without the necessity of stopwatch studies.

We started using this type of analysis in 1937. Our first application, in Boston, was used in developing methods and work place arrangements for use in cutting, packing and freezing fish fillets. The example, however, is more recent than that. It has to do with manufacturing corrugated shipping cases—a much less odoriferous operation.

A new Universal Folder Taper machine had been purchased. The purpose of this machine is to place the corner holding type on the folded, scored sheet of corrugated fiberboard that makes up a shipping case. Its rated capacity is 1500 average sized cases per machine hour. At the time the methods study got underway, production was averaging 300 cases per hour. Ordinary stopwatch type time studies indicated the methods being used in hand feeding the flat sheets to the machine should produce 545 cases per hour or, roughly, a third of the rated capacity of the equipment. Obviously, the key job was the feeding operation, and it was selected for study.

The girl feeding the machine has in front of her a stack of the flat sheets. The feeding operation consists of grasping the top sheet, folding the two ends toward the center so that they meet and then pushing the folded sheet forward to engage it in the feeding mechanism of the machine. This is an extremely fast, short-cycle operation that can not be measured accurately by stopwatch methods.

A detailed breakdown that listed and described each motion of the feeding methods as used by 2 different girls was made, and the elements of each method were measured, using methods time measurement data. With that data available, it was possible to develop an improved or ideal method of feeding.

How was the new method developed?

1. By insuring proper location of the stack of flat sheets relative to the machine, the distance that the hands had to travel in moving through the cycle was reduced.

2. By fanning the stack of flat sheets, thereby facilitating the grasp element and reducing the time required.

3. By minimizing the wait time that the feeder previously had while holding the folded sheet in position for the machine to pick it up. That was done by increasing the speed of the machine.

The proposed new method was further checked, operators were trained in its uses and today the equipment is producing its rated capacity.

This is another example of a practical application of time and motion study techniques; in this instance there was applied a measuring device more accurate in a sense than the stopwatch.

SUMMARY

Industrial engineering in our company consists of 10 primary, related functions: Work Measurement (time and motion study), Methods, Standard Costs, Material Handling, Plant Layout, Production Planning, Wage Incentives, Work Simplification and Employee Suggestion Plan Programs, and Inventory Control Systems.

Our chief objective is to reduce manufacturing costs by increasing the productivity of men and machines. As has been exemplified, the application of time and motion study techniques provides us with much of the basic data from which we work.

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Some Factors Affecting the Pectin Grade of Apple Pomace[a]

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(Manuscript received June 4, 1952)

Pomace samples were prepared, dried in a laboratory drier under varying conditions of temperature and time, and evaluated for pectin grade. Apples were kept in cold storage, and the changes in grade of pomace observed. Pomace from rotten apples was compared with that from sound apples. The effect of allowing pomace to stand before drying was studied. Pomace dried by various commercial methods was compared with that dried in the laboratory drier.

The commercial value of apple pomace depends largely on the amount and quality of the pectin that may be extracted. It is well known that the grade or quality of pomaces varies widely with the source of raw material and the method of treatment. Several of the factors affecting pomace grade have previously been studied. For example, Burroughs, Kieser, Pollard and Steedman *(2)* have compared the jellying power of pomace from immature, normal and overripe apples. Charley, Burroughs, Kieser and Steedman *(4)* have reported on the effect of allowing pomace to stand before drying. Mottern and Karr *(5)* have discussed the grades of various types of commercial pomace. The work described in this paper was undertaken in order to extend the information available from the foregoing sources, as well as to find other variables that might be related to pomace grade.

EQUIPMENT AND MATERIALS

The first requirement for these studies was to develop a standard method for drying pomace in the laboratory. The drier utilized for this purpose is portrayed in Figure 1, which shows a vertical cross section. The frame is constructed of plywood panels, the front panel being removable to give access to the four drying trays, which slide in and out on ⅜" by ½" wooden cleats. The trays, 1, 2, 3 and 4 are 8½" by 9", inside dimensions, and are made from ⅜" by 1" wooden frames, with bottoms of 18-mesh bronze screen. The heat is provided by two 600-watt nichrome heating elements, denoted by the numeral 5,

[a] Presented at the Twelfth Annual Meeting of the IFT, Grand Rapids, Mich., June 11, 1952.

[b] One of the laboratories of the Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, United States Department of Agriculture.

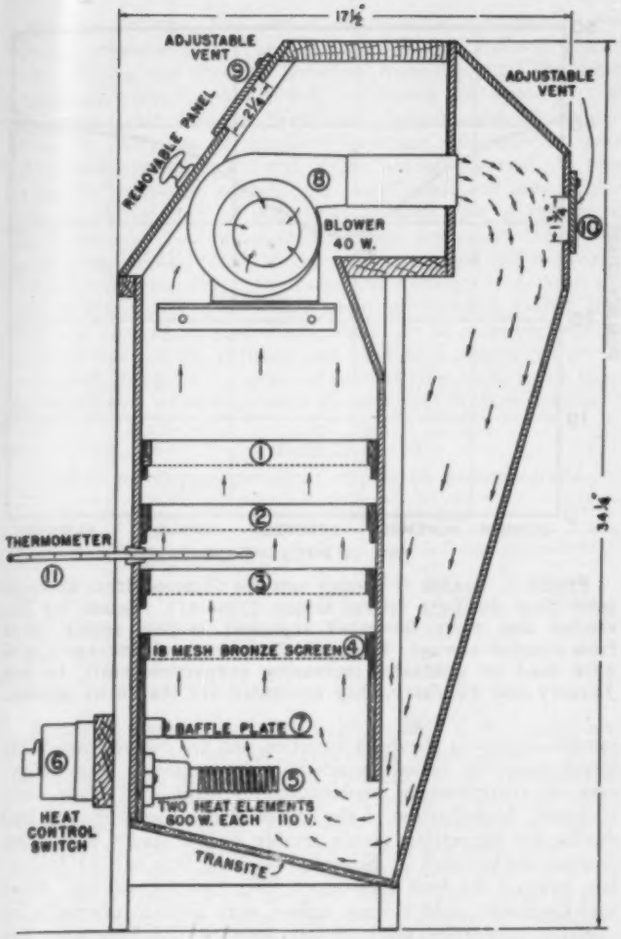

Figure 1. Cross section of laboratory pomace drier, showing circulation of air through drying trays (1, 2, 3, and 4).

placed below the trays and controlled by a 3-position switch, 6. A sheet-metal baffle plate, 7, prevents fine material from falling on the heating elements.

Circulation is provided by a 40-watt rotary blower, 8, mounted in the top of the drier. The direction of circulation is shown in the figure. Adjustable vents, 9 and 10 are provided to control the circulation. Vent 9 is normally kept closed. When vent 10 is fully open, the hot air—drawn upward through the trays—is largely exhausted; but recirculation may be increased by partially closing this vent. Recirculation makes the control of temperature more difficult and increases the danger of overheating. Therefore, in the current studies, vent 10 was left fully open at all times. A thermometer, 11, is inserted through a hole in the side panel between the second and third trays.

The normal load of pomace was about 700 g. per run, or 175 g. per tray, which is approximately 350 g. per sq. foot of tray area. The blower was started, and the heater turned to the high position until the desired maximum temperature was approached. The switch was then turned to medium or low, and the temperature maintained by alternating between 2 adjacent positions. With a little practice, a fairly constant temperature could be maintained in this way. In later experiments, a variable transformer was inserted between the heater and the source of current, permitting closer temperature control with less attention.

During the drying, the positions of the trays were shifted or rotated every 15 minutes by removing the bottom tray, shifting the other trays down one position, and replacing the bottom tray in the top position. The moisture contents of the dried pomaces ranged from 1 to 5%.

EXPERIMENTAL PROCEDURES AND RESULTS

Preparation of pomace. The apples were washed and carefully trimmed to remove all damaged tissue and then passed through a hammer mill. Fixed blades with a blunt serrated edge, and a screen with ½" holes were used. The pulp was immediately pressed on a hydraulic press with a 17" square platen. The press cake was broken up by hand and re-pressed on a laboratory-type hydraulic press. The resulting material (containing from 60 to 72% moisture) was again broken up, spread out on the drying trays, and dried. The dried pomace was weighed and stored in air-tight jars.

Evaluation of pomace. The grade of a pomace may be defined as the number of grams of sugar that can be converted into a jelly of standard strength by the pectin extracted from one gram of the dry pomace. For testing the jellies, use was made of the Delaware Jelly Tester, developed by Baker *(1)*, which measures the hydrostatic pressure, in centimeters of water, required to break the jellies by forcing a plunger of standard dimensions through the surface. The instrument was calibrated *(5)* by measuring the values for jellies made up with varying quantities of a standard pectin and plotting the ratio of true grade to assumed grade against these values to give a calibration curve.

The method used for the extraction of the pomace and the preparation of the test jellies was based on the method of Mottern and Karr *(5)*, with several modifications, and with several features proposed by W. A. Rooker *(7)*. The dried pomace was ground in a Wiley mill to pass a 4-mm. screen, and the moisture content was determined by drying in a vacuum oven at 70° C. to constant weight. One hundred g. of ground pomace were weighed into a tared 2-liter beaker. Four g. of commercial sodium tetraphosphate, $Na_6P_4O_{13}$,[c] were added, followed by 1500 ml. of water. The pH of the mixture was brought to 3.2 by the addition of hydrochloric acid (1:1). It was then heated to the boiling point and held at 90° to 100° C. for 30 minutes. After cooling to 50° C., the beaker was weighed and net contents recorded. The suspension was then drained through cheesecloth. The viscosity of the drained liquid was determined by means of an Ostwald viscosimeter, and the percentage of soluble solids by reading from the sugar scale of an Abbe refractometer.

The amount of extract to be taken for the preparation of the test jellies depends upon the grade of the pomace. This may be estimated roughly from the viscosity of the extract. Table 1 indicates the amount of sample required for extracts of various relative viscosities. In most cases these values gave jellies falling within suitable limits for testing. With pomaces of very low grade, it was necessary to concentrate the extract by vacuum evaporation.

TABLE 1

Relative viscosity versus weight of extract and assumed grade

Relative viscosity of extract	Weight of extract required grams	Assumed grade of extract
Under 15	340	1.53
15-25	320	1.63
25-35	300	1.74
35-45	280	1.86
45-55	260	2.00
55-65	240	2.17
65-75	220	2.36
Over 75	200	2.60

The extract was weighed, in duplicate, into tared 800-ml. beakers. If the weight of sample used was less than 340 g., it was made up to that amount by the addition of water. The liquid was heated to boiling on a hot plate, and 520 g. of sucrose, less the weight of solids in the extract (calculated from the refractometer reading), were added and dissolved as rapidly as possible by stirring. The beaker was returned to the hot plate, and the boiling continued until the net weight of the solution was reduced to 800 g. The solution was then allowed to cool, with a thermometer suspended so that the bulb was near the center of the liquid. When the solution had cooled to 97° C., it was skimmed, and at 96° C. poured rapidly into six 100-ml. beakers, each containing 2.4 ml. of tartaric acid solution (287 grams per liter). The acid was distributed by stirring briskly

[c] Kindly supplied by Rumford Chemical Works, Rumford, Rhode Island.

for 3 to 5 seconds. The beakers were covered when cool enough to avoid the condensation of moisture on the under side of the watch glass covers. The jellies stood overnight before testing.

The jellies were tested without being removed from the beaker. Readings of pressure to the nearest centimeter were taken at the instant when the plunger broke through the surface of the jelly. The 6 readings for each batch of jelly were averaged (after eliminating any reading that varied more than 20% from the average), and the ratio of "true grade" to "assumed grade" was read from the calibration curve. The grade of the pomace was calculated from the following equation:

$$G = \frac{AG \times R \times W}{S}$$

where G = the grade of the pomace; AG = the assumed grade given in Table 1 (obtained by dividing the weight of sugar by the weight of extract); R = the ratio of true grade to assumed grade as determined by the jelly test, W = the total weight of the extraction mixture; and S = the weight of the pomace sample taken, on the moisture-free basis.

Effect of drying temperature. Optimum drying temperature was determined by drying samples of the same pomace at maximum temperatures of 110°, 100°, 90°, 80°, 70° and 60° C. (230°, 212°, 194°, 176°, 158° and 140° F.). The grades of the dried pomaces increased with decreasing drying temperatures from 110° to 90° C. (230° to 194° F.), at which point pomace of maximum grade was obtained. Drying was complete in one hour at this temperature. At lower temperatures the drying period was longer, and since no improvement in grade was obtained by further reduction of the temperature, 90° C. (194° F.) was chosen as the maximum drying temperature in all succeeding experiments.

Due to the position of the thermometer between the two middle trays of the drier, the temperatures shown here do not represent the temperature of either the incoming or outgoing air, but an intermediate value. No measurement was made of the temperature gradient between the air passing through the bottom and top trays, but the short distance between the two, and the relatively high air velocity, would indicate that the gradient would not be great.

Although these results seem to indicate that drying in the laboratory drier at 90° C. (194° F.) causes little or no degradation of the pectin, it is, of course, impossible to state categorically that such is the case. In an effort to check this point, an attempt was made to find methods that might offer less chance of damage to the pectin. The 2 methods chosen were: drying in a vacuum oven at various temperatures below 90° C. (194° F.), and drying under an infrared heat lamp. Combinations of these were also tried. These methods proved to be very slow in comparison with the laboratory drier, and in no cases were pomaces of higher grade obtained.

Effect of length of storage. Carré and Horne *(3)* found that the total pectic compounds in apples (determined by precipitation as calcium pectate) remained practically constant, during cold storage, for about 6 months, but that the pectic constituents of the middle lamella began to decrease slowly after 2 months and more rapidly after 4 months.

Burroughs et al. *(2)* found that with Dabinett, an English variety, pomace from immature apples was slightly higher, and from overripe apples slightly lower in jellying power than that from fruit of normal maturity.

The examination in this laboratory of pomace samples taken regularly from an apple juice plant during a single season (October through February) gave the results shown in Figure 2, where pomace grade is plotted against date of pressing. All

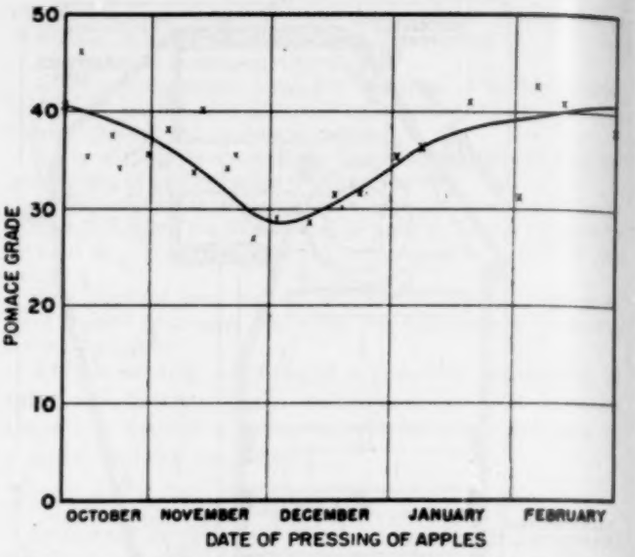

Figure 2. Grades of pomace samples obtained from an apple juice plant during a typical season (1946-47). Values for November and early December represent largely apples taken from common storage. From mid-December, cold storage apples were used in gradually increasing proportion until, in late January and February, they accounted for the entire amount.

samples represent blends of varieties, and the composition of the blends naturally varied considerably from time to time. However, no correlation of predominant varieties with grade could be found. Investigation of the source of the apples showed that during the harvesting season freshly picked apples were used. During the last half of November and the first half of December, most of the fruit was drawn from common storage. From mid-December, cold storage apples were used in gradually increasing proportion until, in late January and February, they accounted for the entire amount. The shape of the curve suggests that the use of common storage apples was reflected in lowered grade of pomace, but that the introduction of cold-storage apples brought the grade back up to its original average.

Laboratory tests on the effect of cold storage on pomace grade were made during 2 different seasons. In the first experiment, batches of utility grade McIntosh, Golden Delicious, Jonathan, Stayman Winesap and Rome Beauty apples were taken from cold storage and each batch thoroughly mixed. A half bushel of each variety was ground and pressed, and the pomace dried and graded as described above. The remainder of the apples were kept in cold storage, and samples were removed and graded at intervals. The results are given in Table 2. Of the 5 varieties, Golden Delicious and Stayman were the only ones that showed a marked decrease during any part of the period. The other varieties showed some decrease in the last column, which may or may not be significant.

In the second experiment, juice grade apples of 4 varieties (Stayman Winesap, McIntosh, Red Delicious and Rome Beauty), picked in October, were placed in storage at 35° F. in a room containing an activated-carbon air purifier. The Stayman Winesap and Red Delicious were largely of normal maturity and color, but varied in size and shape. The McIntosh and Rome Beauty were small and rather immature. Samples of pomace from each variety were prepared and graded at 1-month intervals, beginning after one month's storage and extending to

TABLE 2

Effect of storage period of apples on pomace grade (1946-47)

Variety	Grade at 1st test	Days from 1st test	Grade	Days from 1st test	Grade	Days from 1st test	Grade
McIntosh	32.4	47	35.7	79	31.6	112	28.1
Golden Delicious	39.6	48	29.6	78	22.8	.....	.....
Jonathan	31.9	49	32.2	80	35.2	115	29.6
Stayman Winesap	18.8	49	32.5	83	22.1	116	26.0
Rome Beauty	36.4	35	36.9	70	35.8	101	32.5
Average	31.8		37.4		29.5		30.1

6 months. During this period all varieties underwent considerable deterioration. The Stayman Winesap suffered mostly from splitting and the Red Delicious from dry rot. The other varieties developed ordinary soft rot during the latter part of the period. All varieties eventually showed some shrivelling. With the exception of the Red Delicious, all varieties were rather badly rotted by the end of the 6-months' period. In preparing the pomace, of course, only sound tissue was used. Table 3 shows the variation of pomace grade with time of storage of the 4 varieties. The values seem to show no regular trend, and considering the limitations of the grading method and the possibilities of sampling error, the variations were not large until the fifth or sixth month, at which stage all varieties except Red Delicious showed an appreciable drop. It is probably safe to conclude that for the varieties and conditions employed there is no marked change in the grade of pectin in the sound tissue from the first month of storage until the approach of deterioration.

TABLE 3

Effect of storage period of apples on pomace grade

Date of preparation of pomace	Months in storage	Grade of Pomace			
		Stayman	McIntosh	Red Delicious	Rome Beauty
November	1	27.8	25.2	27.6	29.2
December	2	26.8	25.0	28.8	27.4
January	3	26.3	.....	30.2	.....
February	4	29.6	26.2	30.0	26.1
March	5	24.9	27.6	27.2	28.8
April	6	22.4	24.3	27.5	24.8

Effect of rotten fruit. The next question to be studied was the effect of the presence of rotten tissue in the pomace. At the conclusion of the storage period (6 months) the remainder of the McIntosh apples from the preceding experiment were approximately half rotten. They were ground without sorting or trimming, and the pomace was prepared in the usual way. This pomace had a grade of 13.6, as compared with 24.5 for sorted and trimmed apples from the same batch. This seems to confirm the natural assumption that rotting results in decomposition of the pectin.

Effect of delay in drying. It is not generally recognized in this country that pomace must be dried promptly after pressing if the grade is to be maintained. Charley et al. in England *(4)* found that pomace which was allowed to stand before drying lost from 21 to 39% of its jellying power in one day, and from 40 to 49% in 2 days. In order to determine the rate of deterioration, pomace was prepared from Stayman Winesap and from Red Delicious apples (3 months' storage) in the manner previously described. One portion from each variety was dried immediately, and other portions were allowed to stand at room temperature for 1, 2, 3 and 6 days, respectively, before drying. Within one day a faint moldy odor was detectable. In 2 days the moldy odor was quite noticeable. In 3 days the odor was quite strong and mold growth was distinctly visible. After 6 days, both samples were very moldy. The results of the grade determinations of these samples are shown in Table 4. The losses in grade amounted to about 40% after one day, and about 50% after 2 days. The extracts prepared from samples that had stood for 3 days or longer gave jellies which were too weak to test, indicating a loss of more than 60%.

Peel and core pomace. Since pomace is prepared commercially both from whole apples and from peels and cores, it is of interest to know how the pomace from peels and cores compares in grade with that from the remainder of the apple. Samples of Stayman Winesap, York Imperial, and Rome Beauty were peeled and cored. The peels and cores were ground and pressed, and the pomace was dried and graded. The remaining portions of the apples were similarly treated. Two of the varieties were tested again in the same manner after about 3½ months' cold storage. The results, shown in Table 5, show that the pomace from peels and cores was from 25 to 70% higher in grade than that from the rest of the apple tissue.

TABLE 4

Effect of time of standing before drying on pomace grade

Variety	Grade after standing for				
	0	1 day	2 days	3 days	6 days
Red Delicious	30.2	18.1	14.6	Too low to test [d]	
Stayman Winesap	26.3	15.3	13.1	Too low to test [d]	

[d] Below 10.0.

TABLE 5

Comparison of grade of pomace from peels and cores with that from remainder of apple

Variety	Fraction	Grade before storage	Grade after 3½ months' storage
Stayman	Peels and cores	28.9	27.7
	Remainder	18.7	16.2
Rome Beauty	Peels and cores	38.8	31.8
	Remainder	25.0	21.2
York	Peels and cores	21.8	.....
	Remainder	17.3	.....

Comparison of Commercial Drying Methods

The purpose of this part of the study was to compare the effect of various commercial drying methods with that of the laboratory drier and, if possible, with each other, with regard to pectin grade. The laboratory drier was taken to 3 successive apple processing plants and set up near the pomace drying equipment. A sample of wet pomace was taken from the line just before entering the drier, and dried on the laboratory apparatus. The length of time required for pomace to pass through the commercial drier was estimated, and after that interval a sample of the material emerging from the dry end was collected. These 2 samples, which were obviously alike before drying, were paired together in the grade comparison. Six pairs were obtained from each plant.

The first plant visited was making canned sliced apples from York Imperial. The peels and cores, together with some cull apples, were ground and pressed. The pomace was reground and pressed again before drying. The drier was a Rotolouvre type, 24 feet long by 6 feet in diameter. Flue gas from a coke furnace was used as the drying agent. The gas entered the furnace at 550° F. and left it at 230° F. The estimated time required for the pomace to pass through the drier was 20 minutes. The average moisture content of the dried pomace was about 7%. Table 6 shows the grades of the six pairs of samples dried on this equipment and on the laboratory drier. The mean difference in grade was 5.5 points in favor of the laboratory drier, and the application of "Student's" formula for paired samples *(6)* shows that this difference is significant.

The second plant (which was under the same management as the first) was using the same kind of apples

TABLE 6

Grades of pomace samples. Comparison of laboratory drier with commercial direct-fired rotolouvre drier

Pair number	Grade of pomace dried in		Difference
	Laboratory drier	Commercial drier	
1	38.5	34.3	4.2
2	38.3	36.6	1.7
3	34.0	28.6	5.4
4	35.6	29.5	6.1
5	37.9	25.9	12.0
6	36.2	32.3	3.9
Mean	36.7	31.2	5.5*

* Sigificant at 5% level.

and making a similar product. The drier was of the same type, but was 20 feet long and 5 feet in diameter. Steam-heated air was used as the drying agent. The hot air entered the drier at 330° F. and left it at 160° F. The estimated time of passage through the drier was 45 minutes. The average moisture content was below 3%. Samples were taken in the same way as before. Table 7 shows a mean difference in grade of 2.5% in favor of the laboratory drier. Comparison with Table 6 shows that the mean grades obtained with the laboratory drier were essentially the same in both cases, as would be expected from the similarity of the raw material. The difference in grade of the commercially dried samples must therefore be due to the difference in drying methods. The mean difference in Table 7, although less than half as great as that in Table 6, is still statistically significant. It may be concluded that both of these commercial driers gave pomace of somewhat less than the maximum possible grade, and that the direct fired drier gave somewhat lower grades and more variation. Probably these differences reflect only the differences in operating temperatures between the 2 driers, and have nothing to do with the use of flue gas or heated air *per se*.

TABLE 7

Grades of pomace samples. Comparison of laboratory drier with commercial steam-heated rotolouvre drier

Pair number	Grade of pomace dried in		Difference
	Laboratory drier	Commercial drier	
1	36.7	33.7	3.0
2	39.7	34.6	5.1
3	37.8	35.8	2.0
4	36.0	34.4	1.6
5	38.1	34.8	3.3
6	33.7	34.0	—0.3
Mean	37.0	34.5	2.5[a]

[a] Significant at 5% level.

The third plant was making apple sauce from a mixture of varieties, with Rhode Island Greening predominating. The peels and cores were ground and pressed only once. The drier was a rotary steam-tube type, using steam at a pressure of 40 pounds per sq. inch. The temperature within the drier was not recorded. The estimated time of passage through the drier was one hour. It was observed that some of the wet pomace stuck to the tubes and was scorched. This was probably due to the high moisture content of the single-pressed pomace. The average moisture content of the product was about 7%. The data, shown in Table 8, indicate a mean difference of 7.7 points in favor of the laboratory drier. Since the raw material and the process were obviously quite different from those in the other plants, no comparisons can fairly be made between the relative merits of the steam tube drier and the Rotolouvre driers. It can only be stated that under the circumstances here described the differences in grade, in favor of the laboratory drier, were quite marked and highly significant. This pomace, as may easily be guessed, could be disposed of only as stock feed.

It should be observed here that in commercial pomace drying, accurate control of temperature and an even flow of material into the drier are essential for the maintenance of a good pomace grade. Carelessness in attention to these details sometimes results in obvious scorching, and probably even more frequently in damage which, although not visible, is reflected in lowered grade.

TABLE 8

Grades of pomace samples. Comparison of laboratory drier with commercial rotary steam-tube drier

Pair number	Grade of pomace dried in		Difference
	Laboratory drier	Commercial drier	
1	28.7	24.5	4.2
2	29.7	18.2	11.5
3	24.0	18.5	5.5
4	23.8	19.6	4.2
5	26.2	15.8	10.4
6	24.4	13.9	10.5
Mean	26.1	18.4	7.7[a]

[a] Significant at 1% level.

SUMMARY

Apple pomace may be dried in a laboratory drier at 90° C. (194° F.) with maximum retention of grade. Pomace from apples kept in cold storage shows, in most cases, no marked change in grade, when only sound tissue is used, until the approach of complete deterioration. The inclusion of rotten tissue lowers the grade. Pomace which is allowed to stand at room temperature before drying loses about 40% in grade after one day and about 50% after 2 days; after 3 days it is too low to test, indicating a loss of more than 60%. The pomace from peels and cores is from 25 to 70% higher in grade than that from the peeled and cored apples. Pomace dried in commercial driers is lower in grade than that from the same apples dried in a laboratory drier, the differences being slight in some cases, although statistically significant.

Acknowledgments

The authors gratefully acknowledge the generous and helpful cooperation of the following companies: Berks-Lehigh Cooperative Fruit Growers, Inc., Fleetwood, Pa.; Knouse Foods Cooperative, Inc., Peach Glen and Orrtanna, Pa.; Adams Apple Products Corp., Aspers, Pa. We are also indebted to Margaret H. Stirton for carrying out much of the pomace grading involved in these studies.

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AUTHOR INDEX, VOLUME 6, 1952

Aceto, Nicholas C. 210, 383
Adams, A. T. 421
Adams, P. 285
Alford, John A. 217
Alstrand, D. V. 185
Ambler, Roberta Connors 190
Anderson, Joyce D. 1
Appleman, M. D. 156, 165, 167
Arkin, David 190
Atkins, C. D. 291
Atkinson, F. E. 431
Avery, Arthur C. 4, 64
Avidor, J. 143
Ayres, J. C. 8, 255, 421

Babad, J. 143
Barer, S. M. 26
Bartron, Lester R. 21
Bates, Charles J. 237
Beavens, E. A. 35, 197
Bell, Thomas A. 468
Bentz, R. W. 302
Bergquist, Dwight H. 201, 262
Bing, Franklin C. 91
Bissett, H. M. 363
Blumer, T. E. 299
Boggs, Mildred M. 53, 179, 438
Borchardt, L. F. 390
Bradley, Ralph Allan 259
Brant, A. W. 204
Brokaw, Charles H. 344
Brooks, Robert F. 147
Buck, Robert E. 122
Bull, Sleeter 354
Bulman, Cornelius 255
Burr, Horace K. 179
Butland, Peter 208

Campbell, L. Leon Jr. 125
Carlin, Agnes Frances 443
Cartwright, L. C. 372
Case, W. H. 464
Cathcart, W. H. 224, 368
Ceaglske, N. H. 26
Clark, W. L. 269
Clifcorn, L. E. 299
Cook, F. H. 390
Coover, Lillian 416
Corrick, J. A. Jr. 64
Crane, John C. 220
Crespo, Silvio 394
Cross, Sherwood T. 21
Cruess, W. V. 110

Davis, Lyle L. 250
Deatherage, F. E. 260
Doan, F. J. 402
Donovan, James 18
Dryden, E. C. 474
Dunker, C. F. 329

Easton, Nelson R. 21
Ebner, Katherine R. 81
Ecklund, O. F. 185
Edelmann, E. C. 368
Edwards, Paul W. 383
Emery, Arthur J. 147
Eolkin, Dave 214
Eskew, Roderick K. 210, 383
Etchells, John L. 468

Farber, Lionel 319
Farkas, Lillian D. 405
Fellers, Carl R. 103
Felt, C. E. 390
Fieger, E. A. 217
Fields, M. D. 329
Fitzwater, W. D. 436
Flores, Hector 6
Folinazzo, J. F. 127, 181
Foth, Janiece 443
Freeman, A. F. 71, 199
Frey, Charles N. ..... (11) 4
Friedman, M. E. 395
Frost, H. C. 50

Gaddis, A. M. 294
Galloway, Leora S. 16
Garnatz, George 260
Geddes, W. F. 26
Geissenhainer, Eleanor L. 81
Gildersleeve, Nelson 41
Gilpin, Gladys L. 81
Girardot, Norman F. 140
Godkin, W. J. 224
Goldblith, Samuel A. 237
Graham, R. P. 411
Gregory, Mrs. Raymond W. 66
Griffin, William C. 21
Grunpeter, A. 143
Guymon, James F. 359

Hahn, Saul S. 156, 165
Hall, A. S. 71
Hall, Lloyd A. 456
Hammerle, Olivia A. 237
Hand, D. B. 269
Hankins, O. G. 161
Hanson, Helen L. 1, 308
Harper, G. S. 304
Harris, Jay C. 275
Hayhurst, L. J. 454
Hays, G. L. 386
Hedrick, L. R. 107
Heitz, Joseph E. 359
Hemphill, Frances I. 98
Hendrickson, R. 350
Hicks, E. W. 175
Hills, Claude H. 474
Hoersch, A. Jr. 383
Hoffert, Eugenia 337
Holden, F. R. 278
Hucker, G. J. 147
Hugli, Etheleen 129
Hundley, James M. 399
Hustrulid, Andrew 311

Jarvis, N. D. 113
Johnson, Duane K. 242
Johnson, Gestur 242
Johnson, Verlin K. 354
Jones, A. H. 304
Joslyn, M. A. 133

Kaplan, Milton T. 167
Katz, Robert 44
Keller, George J. 35, 197
Kelley, Patricia H. 372
Kelly, Douglas J. 21
Kennedy, Barbara M. 93
Kertesz, Z. I. 68
Kester, E. B. 53
Kimball, Lillian B. 68
Kitson, J. A. 431
Klose, A. A. 308
Kohman, Edward F. 288
Kotschevar, Lendal H. 64
Kraft, A. A. 8
Kramer, Amihud 117
Krum, Jack K. 103

Lambert, E. 133
Launer, Herbert F. 59, 281
Lee, Milford R. 44
Lehmann, Barbara T. 194
Lemon, James M. 366
Lineweaver, Hans 1
Lowe, Belle 337

Mackinney, G. 395
Mackintosh, David L. 170
Makower, Rachel U. 179
Marsh, G. L. 395
Marshall, C. R. 229
Marshall, R. E. 464
Marsteller, Robert L. 119
Maynard, Elliott A. 351
McColloch, R. J. 197
McConnell, John E. W. 76
McNary, Robert R. 418
Mecchi, E. P. 308
Merwin, E. 285
Miller, Erston V. 119
Milner, Max 44
Mist, S. 133
Mogavero, M. 285
Morris, N. J. 71
Morrison, G. W. 278
Morse, Roy E. 6
Moster, J. B. 459
Moyls, A. W. 333, 431
Mrak, E. M. 450
Murdock, D. I. 127, 181
Murray, M. D. 199

Nichols, James B. 170
Nimmo, C. C. 31
Noble, Isabel 311
Norris, K. H. 204
Norris, Willaminta 246
Norton, Karl B. 405
Norton, L. J. 380

O'Connor, R. T. 199
O'Grady, T. J. 302
Olsen, R. W. 350
Ostle, B. 421

Pappas, Harry J. 456
Patton, Vincent D. 418
Paul, Pauline C. 464
Pederson, Carl S. 46
Peryam, David R. 140
Phillips, G. W. MacPherson 210
Phillips, H. J. 74
Plagge, Alma R. 337
Poppoff, I. G. 278
Pottinger, S. R. 28
Powers, John J. 246
Prater, A. N. 459
Pratt, C. D. 425

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CONTENTS

EFFECT OF ANTIOXIDANT ON RANCIDITY DEVELOPMENT IN FROZEN CREAMED TURKEY. Hans Lineweaver, Joyce D. Anderson, and Helen L. Hanson 1

PRESERVATION OF VERY SMALL FISH IN THE PHILIPPINE ISLANDS. Arthur C. Avery 4

DETERIORATION OF ORANGE OIL. Hector Flores and Roy E. Morse 6

POST-MORTEM CHANGES IN STORED MEATS. IV. EFFECT OF PACKAGING MATERIALS ON KEEPING QUALITY OF SELF-SERVICE MEATS. A. A. Kraft and John C. Ayres 8

CONSUMER TRENDS IN NEW FOOD PRODUCTS FOR HOMEMAKERS. A. A. Schaal 13

QUALITY AND PALATABILITY OF LAMB OF THREE DIFFERENT CROSS BREEDS. Ethelwyn B. Wilcox and Leora S. Galloway 16

ENGINEERING CONCEPTS OF CONTINUOUS PROCESSING. James Donovan 18

THE USE OF MODIFIERS IN CHOCOLATE TO RETARD FAT BLOOM. Nelson R. Easton, Douglas J. Kelly, Lester R. Bartron, Sherwood T. Cross, and William C. Griffin 21

AN AUTOMATICALLY-CONTROLLED FIVE-CABINET SYSTEM FOR FOOD STABILITY STUDIES. S. M. Barer, N. H. Ceaglske, and W. F. Geddes 26

FROZEN ATLANTIC OYSTER INVESTIGATIONS. S. R. Pottinger . 28

INFLUENCE OF STORAGE CONDITIONS ON FROZEN AND CANNED APPLE JUICE CONCENTRATES. C. C. Nimmo, L. H. Walker, and Virginia S. Seamans 31

FLAVOR FORTIFICATION OF CALIFORNIA FROZEN ORANGE CONCENTRATE. Randall G. Rice, George J. Keller, and E. A. Beavens 35

BOOK REVIEW 39

REGIONAL SECTION NEWS *6*

SELECTED ABSTRACTS *10*

Authors of papers intended for publication in FOOD TECHNOLOGY should request from the editorial office a copy of the booklet, entitled "Information and suggestions to authors." Manuscripts submitted for publication in FOOD TECHNOLOGY should follow the style described in this booklet.

The Institute of Food Technologists assumes no responsibility for statements in contributed articles appearing in FOOD TECHNOLOGY. Editorials present only opinions of the writers and do not necessarily reflect policies of the Institute of Food Technologists.

TENTATIVE PROGRAM OF THE 1952 IFT ANNUAL MEETING

The 1952 Annual Meeting of the IFT will be held at Grand Rapids, Michigan, June 8-11. The Program Committee has now organized the program which is outlined below. The November issue of FOOD TECHNOLOGY contained an announcement for those planning to submit research papers.

The General Session on Monday afternoon will include the Presidential Address and talks by three top executives in the fields of education and research.

The program on "Recent developments in food packaging problems with flexible and semi-flexible packaging materials" (M. W. Alderman, Chairman) has been thought desirable in view of the emphasis which had been placed on rigid containers at previous meetings.

The session on "Prevention of deterioration of food" (Gordon Mackinney, Chairman) will deal with such problems as browning and other changes resulting from chemical action after the food has been prepared or processed. It will emphasize the methods of retarding or preventing such changes.

The discussion on "Fresh water fish technology" (P. I. Tack, Chairman) seems appropriate in view of the thousands of inland lakes in addition to the Great Lakes in the district where the Meetings are held.

The sessions on "Food research development" (A. L. Elder, Chairman) and on "New food products" (Franklin Bing, Chairman) will continue a program which proved very successful at the New York Meeting. Announcements will be sent out inviting companies to send in new food products which may be exhibited in the room where these meetings are held.

There is some doubt about holding a discussion on "Cereal technology" (Roland W. Selman, Chairman) since the cereal chemists meet shortly before the Grand Rapids Meeting.

The discussion of "Fermented foods" (C. S. Pederson, Chairman) will deal with pickles, olives, sauerkraut, wine, beer, etc. The session on "Sanitation" (D. L. Truax, Chairman) should be of considerable interest. The discussion on "Food Engineering" (C. W. Kaufman, Chairman) will likely include some material relating to time and motion studies and unit operations.

The session on "Utilization of enzymes in food" (Eric G. Snyder, Chairman) will place the emphasis on the control of enzymic reactions in various kinds of foods. The discussions on "Chemicals and additives in foods" (B. E. Proctor, Chairman) could not be more timely. This program is being developed by the IFT Committee appointed to make a study of this subject.

There will be a discussion on "University and industry relations" (L. E. Clifcorn, Chairman) built around a report of the IFT Committee which is making a study of education and curricula in food technology and their relation to the food industry. The session on "Control of microorganisms in foods" (S. A. Goldblith, Chairman) will include sterilization by various radiations and possibly the use of cobalt tubes.

All the above programs are in the formative stage. There will be at least two sessions of contributed research papers. There will be no program on Citrus Technology but an informal round-table discussion will be held. The final program for the Meeting will appear in the May issue of FOOD TECHNOLOGY.

NEW EDITION OF "INFORMATION AND SUGGESTIONS FOR AUTHORS" PUBLISHED

A new and expanded edition of the pamphlet "Information and suggestions for authors" has been published for those writing technical contributions for FOOD TECHNOLOGY and FOOD RESEARCH.

The pamphlet discusses the respective scopes of the two journals and the type of articles suitable for them. A detailed outline is presented of the customary organization of technical papers followed by statements concerning the preferred styles and methods of preparing manuscripts. A discussion of various details like units of measurements and their abbreviations, use of footnotes and literature citations, preparation of tables and figures, etc., follows.

In the following chapter the customary methods of correcting printer's proofs are described. Here a list is given indicating the more common corrections. Instructions for the ordering of reprints follow.

Prospective authors are urged to consult this pamphlet which will be sent free of charge upon a request addressed to the editorial office.

Authorship in FOOD TECHNOLOGY and FOOD RESEARCH is not restricted to members of the Institute of Food Technologists.

IFT COMMITTEE APPOINTMENTS

The following changes in the personnel of the "Committee on pectin standardization" have been announced by President C. N. Frey: H. H. Mottern has resigned from the Committee. New members appointed: R. E. Buck, Phillip E. Gilbert, Jack Nelson, Mamie Olliver and H. H. Shockey.

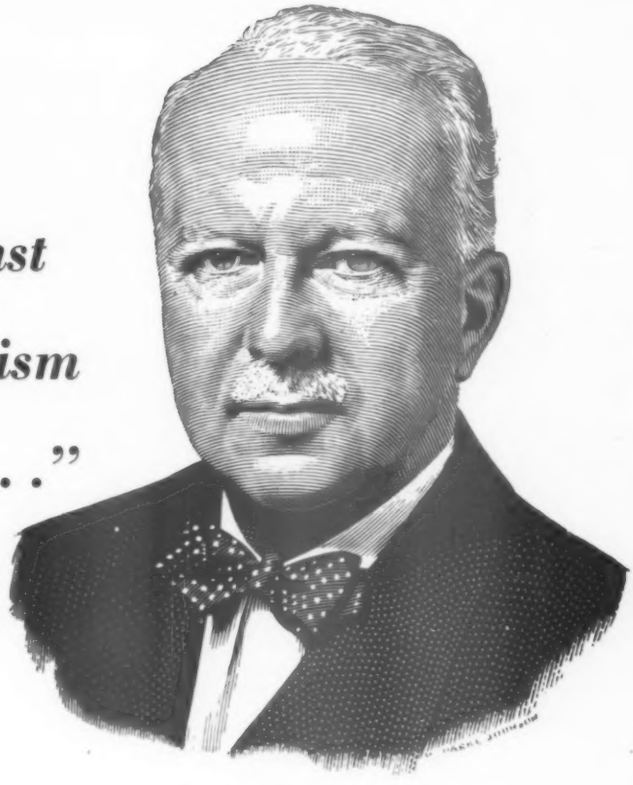
FUTURE DATES FOR FOOD TECHNOLOGISTS

1952

Jan. 14-17	Plant Maintenance Show and Conferences, Convention Hall, Philadelphia, Pa.
Jan. 16-18	Canadian Food Processors Association, Annual Convention, Chateau Frontenac, Quebec, P. Q.
Jan. 17-18	National Pickle Packers Association, Winter Meeting, Roosevelt Hotel, New York, N. Y.
Jan. 19-23	Conventions of the National Canners Association, National Food Brokers Association, and Canning Machinery and Supplies Association, Atlantic City, N. J.
March 3-7	National Association of Frozen Food Packers, Hotel Stevens, Chicago, Ill.
April 20-25	American Association of Cereal Chemists, National Convention, Adolphus Hotel, Dallas, Texas.
April 28-30	American Oil Chemists' Society, Spring Meeting, Shamrock Hotel, Houston, Texas.
June 8-12	**Institute of Food Technologists, Twelfth Annual Meeting, Grand Rapids, Mich.**

(Information concerning future dates of national and international meetings, conventions and exhibits of interest to food technologists should be sent to the editorial office.)

"The immunizer against the disease of communism is a certain feeling . . ."



MR. WALTER S. GIFFORD

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THE INSTITUTE OF FOOD TECHNOLOGISTS

Regional Section News

AMES SECTION

The Ames section has elected the following officers for the 1951-1952 season:

Chairman: R. G. Tischer, Iowa State College, Ames, Iowa.
Vice Chairman: L. B. Drake, American Can Co., Waterloo, Iowa.
Secretary-Treasurer: Frances Carlin, Iowa State College, Ames, Iowa.
Councilor: J. C. Ayres, Iowa State College, Ames, Iowa.
Program Committee Chairman: G. E. Cooper, Rath Packing Co., Waterloo, Iowa.
Membership Committee Chairman: Ruth Chambers, Rath Packing Co., Waterloo, Iowa.

The November meeting was an afternoon and evening session held in the Dairy Industry Building and the Pine Room, Memorial Union, Iowa State College. At the afternoon session the following excellent papers were given:

"Preparation of concentrated milk" by C. A. Iverson, Dairy Industry Department, Iowa State College.
"Recent developments in swine nutrition" by Damon Catron, Animal Husbandry, Iowa State College.
"Highlights of the new lard research project" by Joseph Kastelic, Animal Husbandry, Iowa State College.
"Lard for household use" by Belle Lowe, Foods and Nutrition, Iowa State College.
"Research in developing meat type hogs" by L. N. Hazel, Animal Husbandry, Iowa State College.

After a business meeting, members made a tour of the Dairy Industry Building which included the various phases of dairy manufacturing—milk, cheese and ice cream and dairy research in bacteriology and chemistry.

After dinner Mr. Rodney Q. Selby of the Iowa Development Commission gave an interesting talk on "The Outlook for Iowa Food Industries." He pointed out the fact that food processing is the leading industry in Iowa. It accounts for 34% of the income from manufactured goods and employs 33% of the industrial workers in the state. He stated that some of the important foods processed in Iowa are cereals, meat, poultry, dairy products, vegetables and fruits. In the specialty foods Iowa is the leading producer and a processor of honey and popcorn.

On January 11th, 1952, a meeting will be held which is to include papers on some phases of the poultry industry and on the manufacture of starch. Dr. Leland Underkofler is to talk on fermentation and Dr. Lundberg is to discuss food technology projects at the Hormel Institute.

NORTHEAST SECTION

On December 6th, the Section held an interesting meeting at the Hotel Brunswick, Boston, Mass., when R. C. Sherwood, Technical Director, Sterwin Chemicals, Inc., New York City, was the speaker. Subject of Dr. Sherwood's paper was "The application of certified food colors" which he illustrated with samples and experiments showing some interesting properties of food colors. He also discussed the governmental regulations pertaining to the use of artificial colors in foods.

PHILADELPHIA SECTION

The Section held its November meeting on the 15th in Beck's Restaurant, Philadelphia, Pa. Speaker for the occasion was George Garnatz, Director, Kroger Food Foundation, Cincinnati, Ohio, and his subject was "Experience with a large consumer panel for gauging product acceptability." In conjunction with this meeting, the entire group had the opportunity to test their organoleptic analytical ability, when two products were served for their evaluation and rating. These two foods were served as part of the meal, and the results of the evaluations were commented on by Dr. Garnatz during his address.

Following is a list of the officers elected for 1951-52:

Chairman: Walter Obold, Drexel Institute of Technology, Philadelphia, Pa.
Vice Chairman: Robert C. Bucher, Frank H. Fleer Corp., Philadelphia, Pa.
Secretary: John L. Barnhart, Temple University.
Treasurer: Wassen R. Godfrey, Fritsche Bros.
Councilors: R. G. Foster, Campbell Soup Company, Camden, N. J., and R. A. Pouchain, Tasty Baking Company, Philadelphia, Pa.
Executive Committee: E. Everett Meschter, American Preserve Company, Philadelphia, Pa.; Edwin C. Dryden, Eastern Regional Research Laboratory; Harry Dessender, Virginia Dare Company; Katheryn Langwill, Drexel Institute of Technology, Philadelphia, Pa.; C. D. Trombold, Campbell Soup Company.
Editor, Newsletter: John L. Barnhart, Temple University.

WESTERN NEW YORK SECTION

The New York State Institute of Applied Arts and Sciences, Buffalo, N. Y., provided the setting for the Section's November 5th meeting. Mr. T. J. Otterbacher of the Technical Sales Department of the Corn Products Refining Company, addressed the meeting, on the subject "Starch—Its chemistry and applications."

PERSONNEL

B. A. Bergsteinsson, Director General of Inspection of the Fish Industry of Iceland, accompanied by a group from that country, were welcome visitors at the November 1st meeting of the Northeast Section of the IFT.

Roy C. Newton, Vice-President in Charge of Research, Swift and Co., Chicago, Ill., was awarded the 1952 Medal of the Industrial Research Institute, Inc. The Medal has been awarded annually since 1945 for "outstanding accomplishment in leadership in or management of industrial research which contributes broadly to the development of industry or the public welfare." Dr. Newton is a former President of the IFT.

Charles N. Frey, President of the IFT, W. L. Obold, Chairman of the Philadelphia Section of IFT, and John Barnhart, Secretary of the Section represented the Institute at the Sixtieth Anniversary Celebration of the Drexel Institute of Philadelphia, Pa. on October 31 and November 1. Fred C. Blanck, former President of the IFT was one of the speakers at the event.

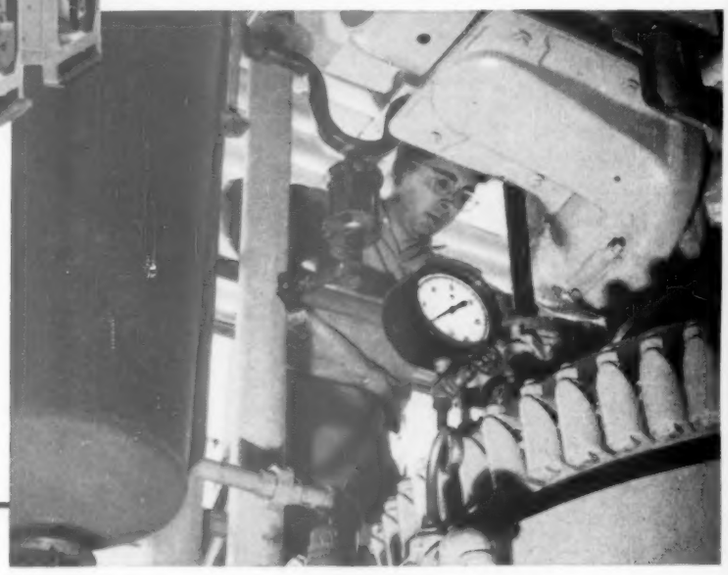
Grant W. Pearcy has been appointed as Chief Chemist for Kitchen Art Foods, Inc., of Illinois. Mr. Pearcy is a graduate of Evansville College and Purdue University, and most recently has been Asst. Chief Chemist for Flour Mills of America in Kansas City, Missouri.

OBITUARY

A. E. Marshall of Providence, R. I., Consulting Chemical Engineer and former President of the Rum-

(Continued on page 8)

Natural



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Regional Section News

(Continued from page 6)

ford Chemical works, died on September 15. Born and educated in England, Mr. Marshall moved to the U. S. in 1912, and was active in chemical manufacturing. He held many corporation and educational appointments and was a past President of the American Institute of Chemical Engineers and a past Chairman of the American Section of the Society of Chemical Industry. He was 67 years old.

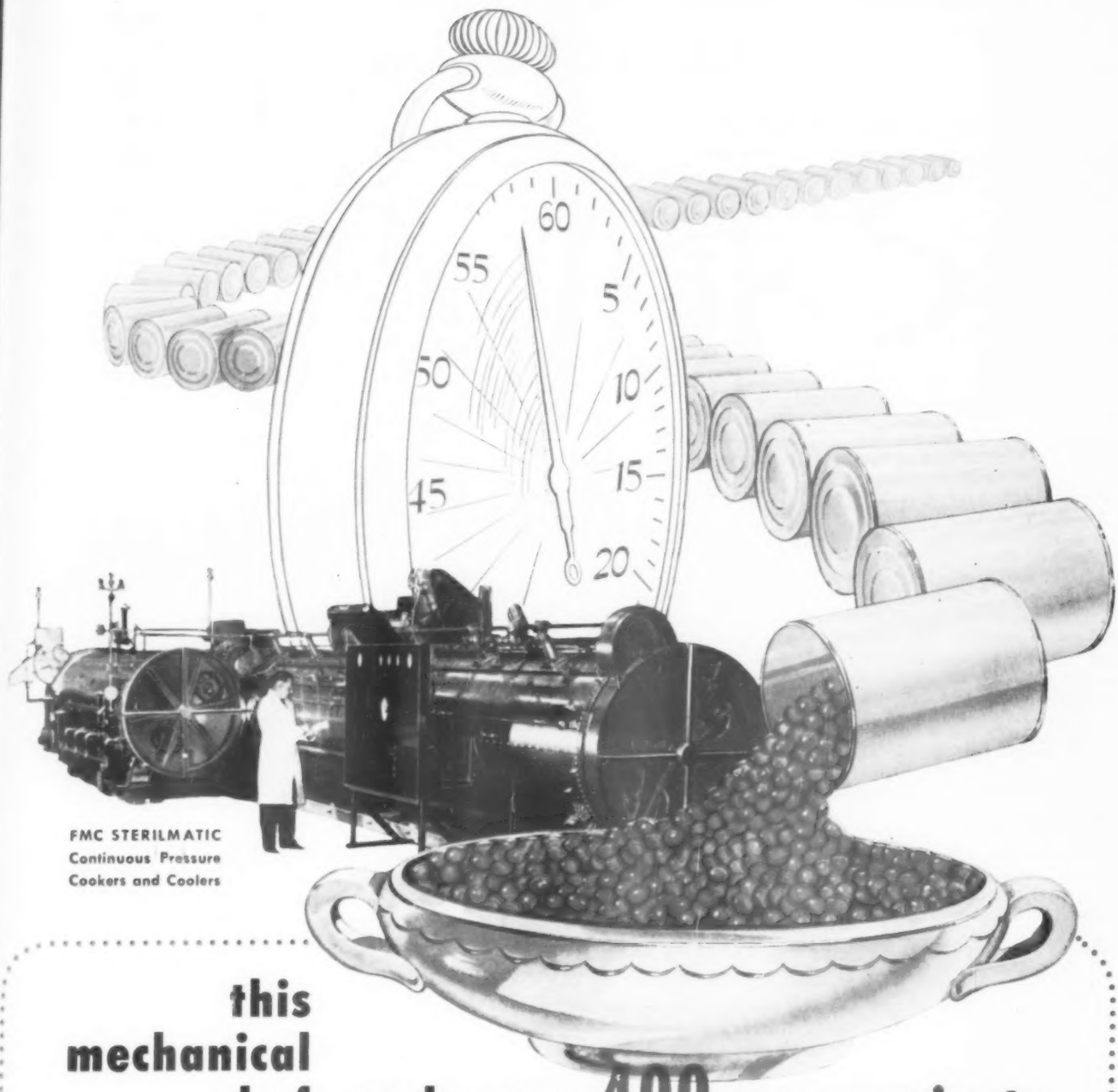
FRANK C. VIBRANS, Chief of the Division of Fat and Oil Technology of the American Meat Institute Foundation at the University of Chicago, died suddenly on October 29. Dr. Vibrans received his Ph.D. from the University of Michigan in 1917 and after some war service joined the Proctor and Gamble Co. of Cincinnati, Ohio, in 1919. He joined the American Meat Institute in 1929 and became especially well known for his work on animal fats. He was 61 years old.

REGULATIONS CONCERNING MANUSCRIPTS SUBMITTED AND PAPERS READ AT INSTITUTE'S ANNUAL MEETING

It is assumed that all manuscripts submitted to FOOD TECHNOLOGY or FOOD RESEACH represent original contributions. Papers which have already appeared in or have been submitted for publication with essentially the same content to other journals, etc., or which are available for distribution in printed or mimeographed form or reproduced in any other manner shall not be published in the Institute's journals.

In order to safeguard the interests of the Institute, the Council at its meeting on June 17, 1951, adopted the following regulations:

1. The term "paper" shall include any presentation for which the title and author are listed on the program and which may be reduced to writing either prior to, during, or subsequent to the meeting at which they are presented.
2. No paper may be presented at an Annual Meeting, which has been offered for publication in any journal except those of the Institute of Food Technologists.
3. No paper shall be presented at an Annual Meeting unless its title appears on the program for the Meeting.
4. Each paper presented before an Annual Meeting shall be the property of the Institute for publication in the Institute's journals. The Editor of FOOD TECHNOLOGY and of FOOD RESEARCH is empowered to release such papers for publication elsewhere. No papers shall be presented at the Meeting unless the author agrees to the condition that the paper is the property of the Institute.
5. In case a title has been submitted and it becomes clear to the Program Committee that arrangements violating the above points have been made by the authors, the paper will be omitted from the program and will not be allowed to be delivered. (The purpose of this provision is to prevent the increasing number of papers which by some arrangements are given at the Annual Meeting but which are printed in journals other than those of the Institute of Food Technologists in violation of points 2 and 4.)
6. The Institute shall not be responsible for statements or opinions advanced by individuals in papers or discussions before its Meetings.
7. The President shall have authority to exclude any paper from the program at any time prior to its presentation at the Meeting of the Institute.



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Selected Abstracts[a]

ANALYTICAL METHODS

Paper chromatography-instruments and techniques.

MULLER, R. H., AND CLEGG, D. L. *Anal. Chem., 23,* 396-411 (1951).

These studies are concerned with an attempt to learn more about the phenomena involved in chromatographic sepns. in paper. Typical technics are described and some new instrumental approaches are presented. It is shown, by precise semiautomatic methods, how the influence of geometric shape factors can be detd. and predicted. The influence of vapor satn., temp., and previous history of the paper is established. It is shown that the motion of liquids through the paper can be predicted accurately by a knowledge of their surface tension, viscosity, and density. With these technics, it should be possible to predict much of the behavior of a given paper with respect to its suitability for chromatographic work and to extend the methods to the kinetic behavior of the individual fractions undergoing sepn.

Multiple-paper chromatogram.

PORTER, W. L. *Anal. Chem., 23,* 412-13 (1951).

A new app., the "Chromatopack," consists of a pack of Whatman No. 1 filter paper strips compressed between two stainless steel plates. The zones obtained from mixts. of pure compds. were sepd. and yielded up to 10 mg. of each constituent. The method lends itself to easy detection of zone positions with resolution equal to that obtained with single sheets of paper but producing semimicro quantities of pure materials. This extends the usefulness of paper chromatography from a submicroqualitative tool to a semimicropreparative tool.

Automatic fraction collector for chromatographic separations.

DURSO, D. F., SCHALL, E. D., AND WHISTLER, R. L. *Anal. Chem., 23,* 425-7 (1951).

The app. consists of a photoelec. system, controlled by a float, which operates successive pairs of solenoid valves through the medium of a stepping relay. The developers are passed through the column in sufficient vol. and in proper sequence to effect the desired sepn. The app. has been used for the fractionation of hydrolyzates of guaran, xylan, and starch. It may have general application to chromatographic sepns.

New type of chromatographic column.

MILLER, J. M., AND KIRCHNER, J. G. *Anal. Chem., 23,* 428-30 (1951).

Certain fractions of the volatile flavoring constituents of citrus fruits were chromatographed in quantities large enough to perform addnl. tests. To accomplish this a chromatographic column was developed which was self-supporting and was therefore not encumbered by a contg. envelope. The column for which the name "chromatobar" has been suggested, was made from a desired adsorbent and plaster of Paris. After development, the location of the resolved zones could be easily detd. by spraying on the sides of the column a suitable reagent, which could be scraped off before recovery of the resolved compds. A device is described for distributing solvent to the column for development. The operation of the column was demonstrated with some terpenes. The new chromatographic device has many advantages over conventional chromatographic columns, in addn. to the convenience of locating resolved zones.

Report on acetic and propionic acids in bread.

MCROBERTS, L. H. *J. Assoc. Offic. Agr. Chemists, 34,* 284-98 (1951).

A chromatographic method is described for the detn. of acetic and propionic acids in bread by means of a silica gel column.

Paper chromatography of organic acids.

STARK, J. B., GOODBAN, A. E., AND OWENS, H. S. *Anal. Chem., 23,* 413-15 (1951).

The study of the paper chromatography of organic acids was undertaken to provide a simple method for the rapid identification of org. acids in sugar-beet processing liquors. The use of several developing solvent mixts. has been investigated. The R_F values for 18 org. acids were measured. The effect on R_F values of hydration of paper, water content of solvents, temp. of development, and presence of inorg. acids was studied.

The quantitative recovery and colorimetric estimation of amino-acids separated by paper chromatography.

FOWDEN, L. *Biochem. J., 48,* 327-33 (1951).

A ninhydrin method for the estn. of amino-acids after sepn. by filter-paper chromatography has been described. The applications to synthetic mixts. of pure amino-acids are given. The method uses the Moore and Stein (1948) ninhydrin reagent in a slightly modified form, and can be used in the detn. of 1-30 γ α-NH_2-N of an amino-acid. Ammonia absorbed on the paper has been shown to be responsible for the high and variable values of the paper blank previously obtained in ninhydrin colorimetric methods and a means of easily removing this ammonia is described. The residual paper blank after this treatment is found to be low and const. in value for pieces of paper of equal size. When chromatograms were dried in hot air at 70-100°, 20-30% losses of α-amino-nitrogen were found for many of the amino-acids detd. by the method described. When the chromatograms were dried at room temp. after removal of the solvent by washing with ether, the losses were completely eliminated and quant. recoveries of the amino-acids made possible. This new method of drying the papers has made control chromatograms of standard amts. of amino-acids unnecessary, and greatly reduced the labor involved in amino-acid detns. No evidence of losses of amino-acid arising during the running of chromatograms due to trailing or heavy metal complex formation was found.

Separation and identification of some terpenes by a new chromatographic technique.

KIRCHNER, J. G., MILLER, J. M., AND KELLER, G. J. *Anal. Chem., 23,* 420-5 (1951).

A chromatographic method for sepg. terpenes was developed for the detn. of the volatile flavoring constituents of citrus fruit. Adsorbent-coated glass strips analogous to those employed in paper chromatography are used. After the mixt. had been spotted near one end of the strip, the chromatogram was developed with the aid of capillary attraction by dipping in a suitable solvent. The solvent was then evapd. from the strip and the various zones were indicated by spraying with suitable reagents. On spraying with a fluorescein soln. and exposing to bromine vapor, compds. which absorb bromine faster than the fluorescein show up as yellow spots on a pink background. Very unreactive compds. can be located by spraying with a concd. sulfuric-nitric acid mixt. and heating to cause charring of the compds. The technic can be applied to other types of compds. and is a rapid method of checking solvents and absorbents for use on larger chromatographic columns. The term "chromatostrip" has been suggested for application to these adsorbent-coated glass strips.

Determination of moisture content of hard candy.

ANDERSSON, W., AND APENITIS, A. *Intern. Chocolate Rev.,* Jan., Feb., 1950. *Chem. Abstracts, 45,* 5838i (1951).

Weigh the candy (0.7 g.) along with a small stirrer. Add about 0.5 g. H_2O and the heat sample to dissolve the candies. Add 20 ml. abs. alc. and stir. Evap. and dry the residue at 100°. This may be repeated 2 or 3 times and gives an absolutely dry sugar residue.

Determination of citrus pectic substances by optical rotation.

MCCREADY, R. M., SHEPHERD, A. D. SWENSON, H. A., ERLANDSEN, R. F., AND MCCLAY, W. D. *Anal. Chem., 23,* 975-7 (1951).

The optical rotation of a soln. was measured, followed by quant. and selective removal of the pectic compd. with cupric ion. The net rotation was used with the previously detd. specific rotation of the pectic compd. to obtain its concn. Data on the effects of pH, concn., viscosity, alkali, and other factors that influence the rotation of pectic substances suggest that the gen-

(Continued on page 17 following technical papers)

[a] These Selected Abstracts are made available to FOOD TECHNOLOGY through the cooperation of Associate Editor H. A. Campbell and the General Foods Corporation of New York, N. Y. The abbreviations found in these abstracts are similar to those used by Chemical Abstracts.

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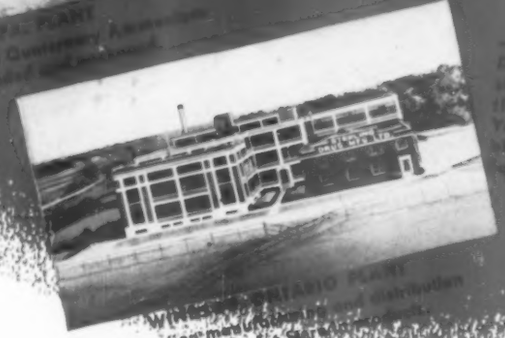

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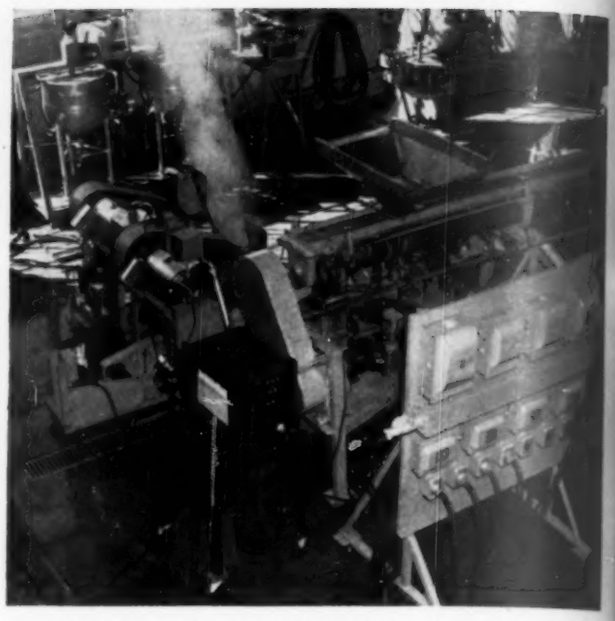

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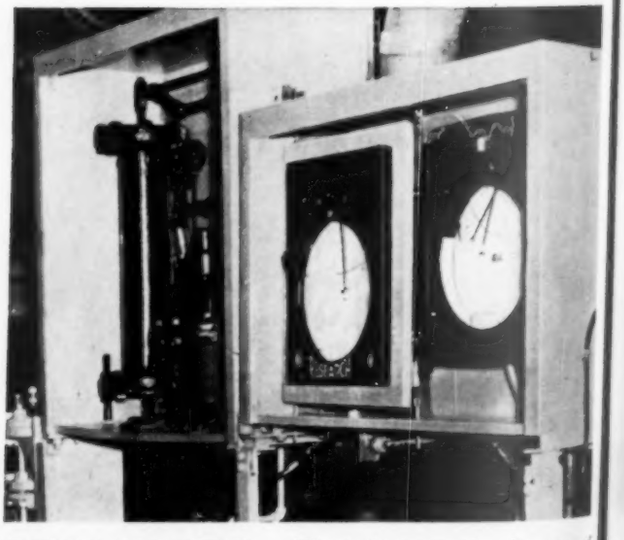

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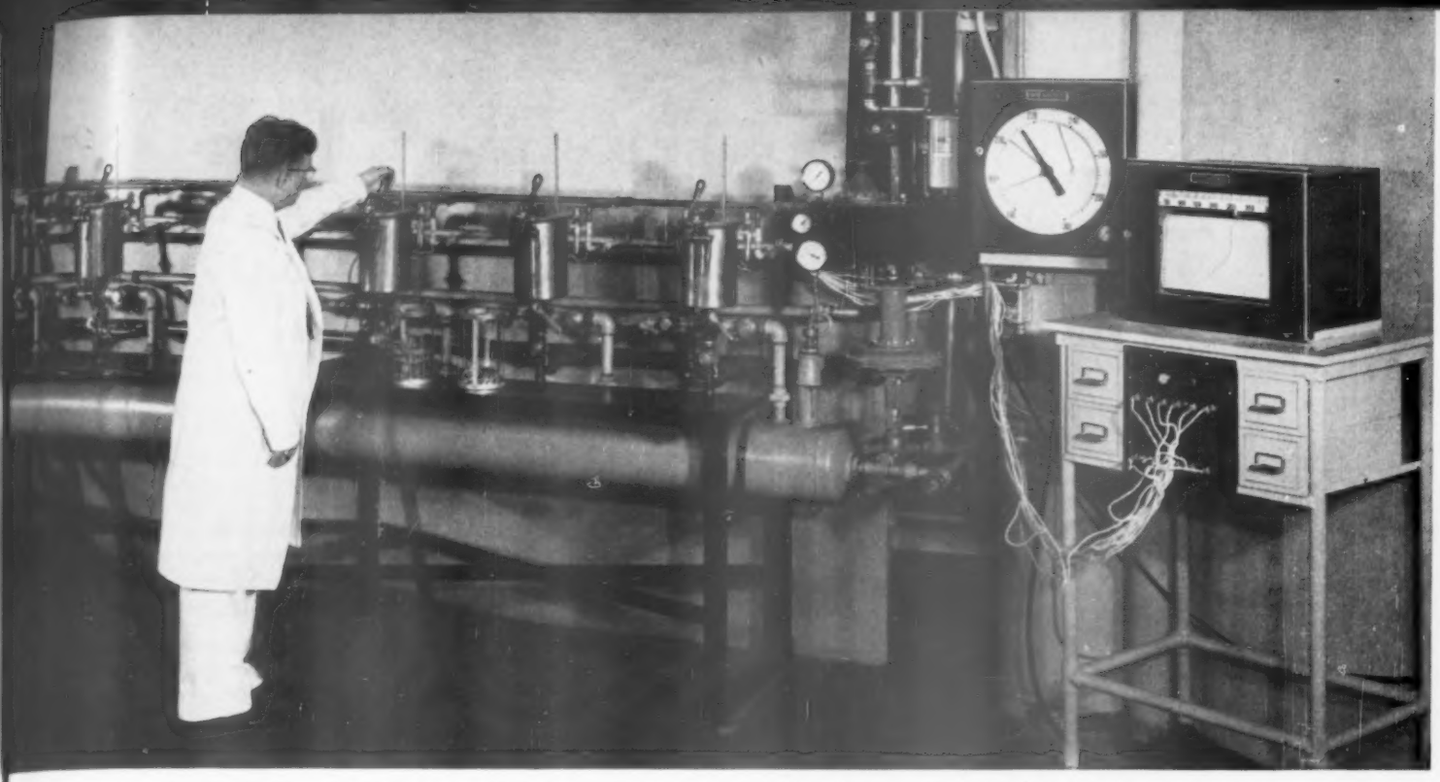

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Abstracts

(Continued from page 10 preceding technical papers)

eral procedure for citrus pectic compds. can be applied to the analysis of pectic compds. from other sources, where their specific rotations and completeness of pptn. with cupric ion can be detd.

BIOLOGICAL SCIENCES

BIOCHEMISTRY

Browning reaction.

HURD, C. D., ROSNATI, L., AND BUESS, C. U. S. Quartermaster Food and Container Institute. Committee on Food Research, 1950. *Bibl. Tech. Repts., 15,* 141 (1951).

This report includes new findings on aldol-type condensations between aldehydes and alphahydroxy ketones, the reaction of benzoin with an amine, and the reaction of benzoin with alanine. In the last expt., isolation of tetraphenylpyrrole, tetraphenylpyrazine, acetaldehyde, and carbon dioxide leads to the suggestion that color formation in the browning reaction may be due in part at least to compds. contg. dipyromethene groupings.

The enzymic synthesis and degradation of starch. XIII. Improved methods for the fractionation of potato starch.

HOBSON, P. N., PERT, S. J., WHELAN, W. J., AND PEAT, S. *J. Chem. Soc.*, 801-03 (1951).

Modification and improvement of the published methods for the prepn. of the two starch components, amylose and amylopectin, are described. Amylose is prepd. by a combination of the methods using aluminum hydroxide and thymol and amylopectin by further fractionation with methanol of amylopectin prepd. by the thymol method.

The enzymic synthesis and degradation of starch. Part XIV. R-enzyme.

HOBSON, P. N., WHELAN, W. J., AND PEAT, S. *J. Chem. Soc.*, 1451-9 (1951).

An enzyme (R-enzyme), which catalyses the scission of branch links in amylopectin, has been isolated from the potato and the broad bean. R-enzyme operates by a purely hydrolytic process and unlike Q-enzyme has no link-synthesizing function. It is a "debranching" enzyme with respect to the predominant type of branch linkage in amylopectin, with 1:6-glucosidic link. It neither makes nor breaks chain-forming 1:4 links and has no action on amylose or on the linear dextrins related to amylose. A convenient method of estg. the activity of R-enzyme is based on the fact that its action on amylopectin or limit β-dextrin is accompanied by a *rise* in the iodine-staining power of the substrate.

Gaging the toxicity of chemicals in foods.

OSER, B. L. *Chem. Eng. News, 29,* 2809-12 (1951).

If the use of chems. in foods can lead to more or better food, their use should be encouraged, with full awareness that unknown or indefinite risks may be involved but with const. effort toward eliminating them.

Proof of safety: some interpretations.

LEHMAN, A. J. *J. Am. Pharm. Assoc., 40,* 305-07 (1951).

Interpretations are presented, according to the objectives sought, of the technics and procedures required by the Food and Drug Administration to establish the safety of a chem. in the form of a food additive, a drug, or an ingredient of a cosmetic. Special emphasis is placed on proof of safety of chemicals used in foods because, in general, these require a more thorough toxicological appraisal than those used in cosmetics or as drugs.

MICROBIOLOGY

Radioisotopes . . . industrial applications.

Atomic Energy N. L., 5, 4, July 31, 1951.

An irradiation service for industrial concerns, making use of thousand curie sources of gamma radiation, is now available at Brookhaven National Laboratory, Upton, L. I., to assist industrial organizations in applying ionizing radiation to industrial processes. Under this service, concerns may arrange with Brookhaven to have small samples of materials or products exposed to radiation from the high gamma sources.

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Abstracts

The protection of bacteria by pyruvate against radiation effects.

THOMPSON, T. L., MEFFERD, JR., R. B., AND WYSS, O. *J. Bact., 62,* 39-44 (1951).

The presence of pyruvate in a bacterial suspension protects the cells against the lethal and the mutagenic action of ultraviolet and X-rays and against the lethal action of H_2O_2. Upon prolonged exposure to ultraviolet, pyruvate solns. become toxic and mutagenic.

Effect of supervoltage cathode rays on bacterial flora of spices and other dry food materials.

PROCTOR, B. E., GOLDBLITH, S. A., AND FRAM, H. *Food Research, 15,* 490-93 (1950).

The lethal effectiveness of supervoltage cathode rays against the various types of microorganisms in food materials was detd. A dosage of 1.33 x 10^6 r.e.p. was found to be effective against these microorganisms in the dry food, and to result in either their death or in a few instances in survival of only a few.

A photographic film dosimeter.

Nat. Bur. Standards (U. S.), Tech. News Bull., 35, 98-102 (1951).

A compact film badge has been developed by the National Bureau of Standards for industrial safety programs and for monitoring in civilian defense. It monitors gamma X-radiation in the quantum energy range from 120 k.e.v. to about 10 m.e.v. Although somewhat less accurate than other types of radiation meters, the badge is rugged and inexpensive, thus lending itself to large-quantity production.

NUTRITION

Nutritional improvement of white polished rice by the addition of lysine and threonine.

PECORA, L. J., AND HUNDLEY, J. M. *J. Nutrition, 44,* 101-12, May 10 (1951).

Highly significant improvement of natural rice protein as it existed in polished rice was accomplished by the addn. of two essential amino acids, lysine and threonine. This combination produced a growth response in white rats three times that obtained with an unsupplemented rice diet. Neither lysine nor threonine, nor any other essential amino acid, added to rice individually produced better growth than rice alone.

Some effects of processing on the nutritive properties of proteins.

BALDWIN, R. R., LOWRY, J. R., AND THIESSEN, JR., R. *Food Research, 16,* 107-17 (1951).

Autoclaving casein with dextrose results in a rapid loss in nutritive value of protein. This loss is over and above that due to heating alone. This loss is due to the destruction of some of the essential amino acids. There is a rapid binding of carbohydrate by the proteins free amino groups up to 80 minutes. Increasing the water content of a casein dextrose mixt. during heating reduces losses somewhat.

Heat inactivation of threonine, glycine, and the acidic amino acids.

EVANS, R. J., BUTTS, H. A., AND BANDEMER, S. L. *Arch. Biochem. Biophysics, 32,* 300-08 (1951).

Little or no destruction of threonine, glycine, aspartic acid, and glutamic acid occurred when soybean oil meal, soybean protein, or the protein plus sucrose, glucose, dextrin, agar-agar, gum arabic, or soybean oil was autoclaved for 4 hr. at 15 lb. pressure. A portion of each of these amino acids was "inactivated" or tied up in such a manner that the biologically active amino acid could be liberated by acid but not by *in vitro* trypsin and erepsin digestion.

The effect of heat treatment on the nutritive value of milk proteins.

COOK, B. B., MORGAN, A. F., WEAST, E. O., AND PARKER, J. *J. Nutrition, 44,* 51-61, May 10, 1951.

The nutritive value of the proteins of two commercially prepd. evapd. milks has been shown, in two different rat growth

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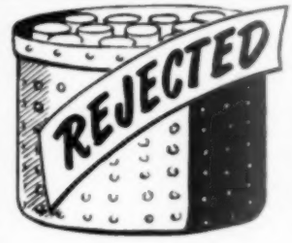

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expts., to be slightly but significantly lower than that of whole, fresh, pasteurized milk. The efficiency of the protein of preheated skim milk powders, when compared with that of a powder which was not preheated, was decreased in proportion to the degree and time of heating. These studies justify the conclusion that the ordinary sterilization or preheating temps. used in the prepn. of evapd. and powd. skim milks decrease the protein efficiency of the milks in proportion to the degree of heat used. While the damage is not marked at the temps. commonly used, it may be increased by careless overheating in com. prepn. of the products and in cooking.

The effect of heat treatment on the nutritive value of milk proteins.

COOK, B. B., MORGAN, A. F., SINGER, B., AND PARKER, J. *J. Nutrition, 44,* 63-81, May 10, 1951.

A significant decrease in the protein efficiency of lactalbumin for the growth of rats was produced by heat only in samples which contained lactose or which had been chemically reacted with lactose. Three forms of change in the nutritive value of the casein appeared to be involved: that caused by water washing alone, apparently not involving lysine and not aggravated by heating; that caused by dry heat, and partially restored by lysine; and that caused by reaction with lactose under the mild conditions, and reparable by lysine. This last change was aggravated by addnl. heat, which caused decreased availability of other amino acids so that the damage was not corrected by lysine.

Studies to determine the nature of the damage to the nutritive value of some vegetable oils from heat treatment.

CRAMPTON, E. W., COMMON, R. H., FARMER, F. A., BERRYHILL, F. M., AND WISEBLATT, L. *J. Nutrition, 44,* 177-89, May 10, 1951.

It is concluded that the primary cause of the lowered nutritive value of diets contg. thermally polymerized linseed oil is the presence of one or more dimeric fatty acid radicals which are in some way inimical to the well-being of the animals. Their deleterious effects could well be aggravated since they are produced at the expense of unsatd. fatty acids, some of which may be those essential to the animal for growth.

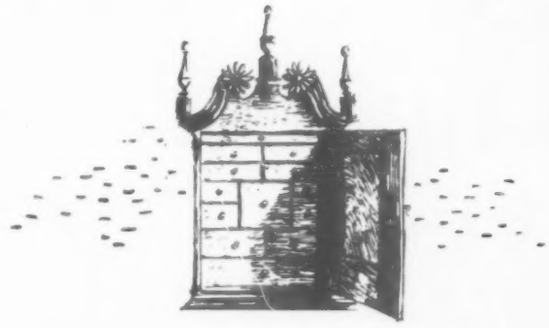
Dietary constituents which may influence the use of food cholesterol.

OKEY, R., PENCHARZ, R., LEPKOVSKY, S., AND VERNON, E. R. *J. Nutrition, 44,* 83-99, May 10, 1951.

Varying degrees of biotin deficiency were produced in young rats by feeding otherwise adequate "purified" diets made high in cholesterol by adding dried whole egg or by adding cholesterol, as such, with dried egg white. These diets furnished 20 to 25% protein and about 13.5% fat. When supplemented with ample biotin, they produced, in control rats, liver fatty acid values 1½ to 3 times, and total liver cholesterol values 6 to 8 times, as high as those of rats fed similar adequate cholesterol-free diets. Most of the increase in cholesterol was in the esterified fraction. Biotin-deficient rats fed the egg diets high in cholesterol failed to store excess liver cholesterol ester, even when they maintained nearly normal food intakes. Loss of subcutaneous and visceral fat occurred at the same time. When rats were transferred from an adequate diet which had produced high liver cholesterol storage to an avidin-rich diet without cholesterol, it could not be clearly shown that the avidin increased the rate of liver lipid depletion. Transfer to an avidin-rich diet contg. cholesterol did, however, result in a marked decrease in liver cholesterol ester, in spite of a continued high cholesterol intake. The possible relationship of biotin supply to the ability of the animal to esterify and store fatty acid as well as cholesterol is discussed.

Nitrogen requirement of normal men on a diet of protein hydrolysate enriched with the limiting essential amino acids.

HOFFMAN, W. S., AND MCNEIL, G. C. *J. Nutrition, 44,* 123-40, May 10, 1951.



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Abstracts

Nitrogen balance expts. were performed in 7 normal male human subjects to det. the nitrogen requirements for equil. when the only significant source of nitrogen was a lyophilized modified casein hydrolysate given orally. Then in the same subjects the nitrogen requirement for equil. was detd. for the same hydrolysate fortified with DL-tryptophan, L-phenylalanine, and DL-methionine in quantities that made the quant. pattern of essential amino acids in the supplemented product equiv. to that found by Rose in his estn. of the min. requirements of the individual amino acids in human subjects. The corrected mean nitrogen requirement for equil. with the unsupplemented hydrolysate was 52.2 mg. per kg. per day, with a standard deviation of 3.5 mg. For the supplemented product the mean nitrogen requirement for equil. was 38.5 mg. per kg. per day, with a standard deviation of 2.1 mg, a reduction of 26%. This reduction was found to be statistically significant.

Free selection of nutrients by hereditarily obese mice.

MAYER, J., DICKIE, M. M., BATES, M. W., AND VITALE, J. J. *Science, 113,* 745-6 (1951).

Groups of obese and nonobese mice were offered three diets representing essentially pure fat, carbohydrate, and protein fortified with minerals and vitamins. The obese animals ate proportionately more fat, less protein, and less carbohydrate than the nonobese animals, with differences in fat and carbohydrate particularly striking. These observations are related to the "glucostatic" theory of the regulation of food intake and the restriction of carbohydrate often used in the management of diabetes.

The citrovorum factor.

WOODS, R. *Borden's Rev., 12,* 59-70 (1951).

The newly discovered *citrovorum* factor, probably identical with both the naturally occurring and synthetic "folinic acid," is at present regarded as a derivative of folic acid. For some organisms this derivative is apparently more active than is folic acid itself. Also, some organisms are able to synthesize the *citrovorum* factor from folic acid, a process which is greatly facilitated by the presence of ascorbic acid, whereas others cannot do so and require CF performed in the nutrient media. Existing evidence seems to indicate further that at least in hematopoiesis the *citrovorum* factor may be the enzymatically active form of folic acid, much in the same manner as pyridoxal is related to the coenzyme form of pyridoxamine (vitamin B_6). 31 references.

The effect of purified diets upon rumen flora.

GALL, L. S., THOMAS, W. E., LOOSLI, J. K., AND HUBTANEN, C. N. *J. Nutrition, 44,* 113-22, May 10, 1951.

Sheep fed three different purified rations, contg. urea-plus-sulphur, urea-without-sulphur, or casein, gave different physical responses as shown by their different growth rates. The sheep on these three rations also supported different rumen flora, as was shown by the results obtained from studying the kinds and numbers of bacteria present in the rumen.

Antibiotic feed supplement (aureomycin) for dairy calves.

RUSOFF, L. L. *J. Dairy Sci., 34,* 652-5 (1951).

An aureomycin supplement (Aurofac) fed at a 2% level in a grain ration stimulated the growth of ruminating dairy calves (14 wk. old) by approx. 35% for the first 6 weeks, and resulted in better appearance and condition of the animals. This increased rate of growth declined thereafter and after 20 weeks of feeding the antibiotic supplement, the calves showed gains similar to those in the control group. The feeding of aureomycin produced no detrimental effects.

FOOD PRODUCTS

Role of starch in bread staling.

SANDSTEDT, R. M., et al. U. S. Quartermaster Food and Container Institute. Report No. 11, November 1, 1949, June 30, 1950. *Bibl. Tech. Repts., 15,* 142 (1951).

The study of the process of starch gelatinization which would eventually shed some light on the reverse processes of staling and retrogradation has involved the effect of several ions and certain org. compds. on the temp. of initial gelatinization of wheat starch. A theoretical consideration of the relation of cer-

tain ions to the structure of water suggests that a critical energy environment represented by some particular degree of water polymerization is necessary to accomplish the dispersal of the starch granule. It seems possible that the observed effects of ions in soln. on starch gelatinization may result from an increase or decrease in the degree of polymerization of water produced by these ions at any given temp. with a consequent increase or decrease in the gelatinization temp. of the starch.

Flavor is a minor cost in bakery products but a major acceptance factor. Part II.

HAMANN, E. H. *Food in Canada, 11*, 16-20, July, 1951.

Since the dough in baked goods is like an emulsion, distribution of flavors in bakery products is readily obtained when they are added to the finished batch. Flavors used in mixes and icings as well as those in cakes are discussed in terms of solvent medium and stability.

Migration and "transplanting" of characteristic flavours of fruit juices and beverages in ion-exchange materials.

ONGARO, D. *Chimica e industria* (Milan), *32*, 375-9 (1950). *Brit. Abstracts, BIII, 32* (1951).

Evidence for the existence of a "flavor complex" is deduced from expts. in which the juice of apples, grapes, cherries, and lemons, and wine, beer, cider, and coffee were passed through 5 different cationic resins and 3 anionic resins. Curves show qualitatively the process of adsorption of this complex for different types of resin and its relation to pH and also the course of the recovery of the flavor complex in the washings from the resins.

Effect of monosodium glutamate on taste of pure sucrose and sodium chloride.

LOCKHART, E. E., AND GAINER, J. M. *Food Research, 15*, 459-64 (1950).

Eight experienced judges of tested sensitivity were used to det. the possible enhancement of supraliminal sweetness (0.036, 0.044, and 0.052 M. sucrose) and saltiness (0.023 M. sodium chloride) by subliminal conc. of monosodium glutamate (0.005 and 0.0010 M.). Monosodium glutamate had no significant effect on the taste of pure sucrose and sodium chloride.

The keeping quality of whole milk powder. III. The use of antioxidants--ascorbic acid and sodium citrate.

DECKER, C. W., AND ASHWORTH, U. S. *J. Dairy Sci., 34*, 633-40 (1951).

Addn. of ascorbic acid and sodium citrate at levels of 100 mg. and 0.1%, resp., per l. of reconstituted milk, did not materially prolong the storage life in air pack of whole milk powders at 85° F. Degree of off-flavor development was dependent upon the developed oxidation-reduction potential values.

Effect of spraying pressure and orifice size on the physical characteristics and keeping quality of spray-dried whole milk.

TRACY, P. H., HETRICK, J. H., AND KRIENKE, W. A. *J. Dairy Sci., 34*, 583-92 (1951).

Percentage of solid particles and trapped oxygen was greater in the powders contg. small size particles. There was some tendency for the powder with the large particle size to deteriorate in flavor during storage.

Mechanisms of chemical changes affecting the acceptability of beverage milk products.

JOSEPHSON, D. V., DOAN, F. J., PATTON, S., HUTTON, J. T., AND PRICE, E. F. U. S. Quartermaster Food and Container Institute. Report No. 17, September 1, 1949, August 31, 1950. *Bibl. Tech Repts., 15*, 142, PB 10319 (1951).

One procedure which has been developed to overcome flavor deterioration in the lipid phase of whole milk powder involves use of a hydrogenated vegetable fat in place of butter fat. As a possible alternative to this procedure, attempts have been made to develop a blend flavored, hydrogenated butter fat for use in dry whole milk. Present efforts are being directed toward development of a practical method for removing serum proteins from milk prior to drying. Fundamental studies concerning the chem. effects of heat on milk have been extended. Addnl. compds. which have been isolated from heated milk are hydroxy methylfurfural, acetol, and acetic acid. Presumptive evidence of the presence of acetaldehyde in heated milk has also been obtained.

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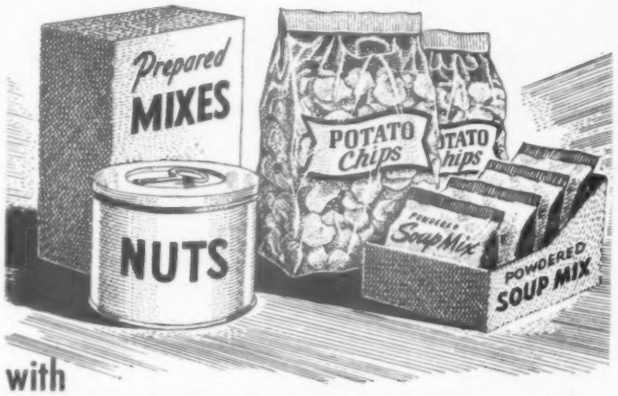

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Abstracts

Canned fresh milk now a reality.

BLOOMBERG, R., AND HESSEY, F. E. *Food Eng., 23,* 71-4, June, 1951.

Fresh whole milk is collected under vacuum in 100 and 200 gallon stainless steel farm tanks and trucked directly to the processing plant. It is homogenized, sterilized, and cooled in a closed system; then piped to the aseptic canning machine where it is filled into sterile cans and sealed with sterile lids. The canned milk is comparable to fresh pasteurized milk.

Sources, production and distribution of pectin.

CHARLEY, V. L. S. *Chemistry and Industry,* 394-400 (1951).

A description is given of pectin production from apple pomace, citrus residues, beet slices, flax, and sisal. Low methoxyl pectins are discussed and the methods of demethylation by the action of acids, alkali, and enzymes is described. A flow sheet is presented for the manufacture of low methoxyl pectins.

Potato starch as an agricultural and industrial product.

DEWILLIGEN, A. H. A. *Chem. Weekblad, 46,* 529-34 (1950). *Brit. Abstracts, BIII, 25* (1951).

Following a discussion of the rheological properties of starch, the influence on these properties of its P content, resulting from fertilizers, has been investigated and shown graphically. Changes during manuf. and storage have also been examd.

New treatment promises control of onion sprouting.

JOHANNESSEN, G. A., AND OEBKER, N. *Farm Research 17,* 12-3, July, 1951.

Maleic hydrazide (active ingredient) applied at the rate of 1.5 pints in 75 gallons of water per acre about two weeks before harvest when onions were going down reduced sprouting of Early Yellow Globe and Brigham. Yellow Globe in storage at 32° and 40° F. Sprouting was reduced also when these onions were placed under conditions similar to those in retail stores for a period of 5 weeks. Of the unsprouted onions, no external differences were noted between those that had been treated with maleic hydrazide and those that had not been so treated.

INDUSTRIAL CHEMISTRY

Ion exchange symposium.

Ind. Eng. Chem., 43, 1062-88 (1951).

Group of nine papers on ion exchange covering recent work in this field.

Selective diffusion into ion-exchange resins. A new method for the purification of the direct cotton dyes.

RICHARDSON, R. W. *J. Chem. Soc.,* 910-14 (1951).

Purification of direct cotton dyes by an ion-exchange technic is described. Use is made of the observation that selective diffusion of ionic species into the bulk of the resin structure depends on the mol. dimensions of the ion. It has been shown that by this means the large org. anions of the dye may be effectively sepd. from those of the much smaller diluent salts.

PHYSICAL CHEMISTRY

Electrophoresis as a criterion of purity in proteins.

HESS, E. L. *Science, 113,* 709-12 (1951).

A review. Specific ion effects, H^+ concn., factors of resolution and sensitivity, and reversible elec. spreading are discussed.

American standard methods of measuring and specifying color.

J. Optical Soc. Am., 41, 431-9 (1951).

A series of standard methods for the measurement and specification of color has been released by the American Standards Association.

The binding of organic ions by proteins. Optical evidence of cooperative interactions with hydrogen ions.

KLOTZ, I. M., AND URQUHART, J. M. *J. Am. Chem. Soc., 73,* 3182-6 (1951).

Addn. of sodium dodecyl sulfate to a buffered soln. of iodinated human serum albumin or of iodinated bovine serum albumin produces a decrease in optical density of the protein in the region of 313 mμ. This drop in absorption demonstrates the uptake of hydrogen ions by the protein concurrently with the binding of anions. The magnitude of the effect is smaller than might be expected from simple electrostatic considerations.

Cellulose: behaviour during bleaching.

KLEIN, A. *Teintex, 15,* 271-81, 329-37, 353-7 (1950). *Textile Research J. Abstracts, 21,* A93 (1951).

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A survey is made of the difficulties confronting the bleacher from the point of view of the type and scale of the process, and the chemicals involved. This is followed by a more fundamental study in which details of development and structure of cellulosic materials are discussed. The presence of substances other than cellulose affect its behavior toward the various physical and chemical treatments involved in the processing of cotton. The microscopy of cellulose fibres is discussed at length and resulting deductions augmented by explanatory diagrammatic models.

PATENTS (U. S.)

Method of tempering wheat.

WARNER, B. R. Assigner to Guardite Corp. 2,560,615, July 17, 1951.

A method of moistening grain comprising freeing the grain from air and supplying an atm. of steam thereto under sub atm. pressure, increasing the pressure by supplying addnl. steam thereto, supplying liquid water to the surface of the grain in a predetd. amt. after pressure increase, then subjecting the grain to an increased vacuum and thereafter supplying atm. air thereto.

Method for dehydrating grain.

LYON, JR., L. N., AND ARNIM, B. F. 2,561,442, July 24, 1951.

The process for drying "paddy" rice which comprises, maintaining moisture-contg. "paddy" rice in intimate contact with a finely-divided moisture-adsorptive clay material at a temp. below about 140° F. and for a time sufficient to effect the desired degree of dehydration of the rice, and sepg. the dried rice from the clay material.

Feed for ruminant animals.

TURNER, C. W. Assignor to American Dairies Inc., and The Quaker Oats Co. 2,560,830, July 17, 1951.

A compn. for improving the utilization of non-protein-nitrogen and cellulose by ruminant animals comprising coated urea, ground grain, a micro-organismal growth stimulating substance of the class of vitamins of the B-complex, proteins, essential amino acid compds. and cultures of the rumen micro-flora.

Apparatus for extracting liquid to form a concentrate.

CUNNINGHAM, G. L. Assignor to The Commonwealth Engineering Co. 2,552,524, May 15, 1951.

In combination in an app. for extracting water from a soln. of water and solids comprising means for conveying a soln.; means for progressively decreasing the temp. of the soln. through a series of temp. changes to cause freezing of the water in the soln. by stages in sep. bodies; means of moving ice crystals so formed in a counterflow direction from stage to stage; means of screening the crystals as they are moved step by step upstream from each stage of freezing; means of extracting the mother liquor from the crystals as they are discharged from the upstream end; and means of returning the liquor free of crystals to the upstream end.

Process for refining soybean oil.

AYERS, A. L. Assignor to Phillips Petroleum Co. 2,561,330, July 24, 1951.

An improved process for producing purified soybean oil, which comprises forming a miscella of soybean oil and a hexane, contacting the resulting soybean oil-hexane miscella with a methanol-water soln. and thereby extg. impurities from oil, sepg. methanol-water soln. contg. extd. impurities from miscella, contacting said miscella with a dilute aq. soln. of an alkali metal hydroxide and thereby extg. fatty acids from oil, sepg. alkali metal hydroxide soln. contg. fatty acids from miscella, sepg. hexane from soybean oil, and recovering a purified soybean oil as a product of the process.

Protecting fabrics, etc., against insect attack.

CROESI, A. Fr. P. 957,590 (through *L'Ind. Text., 67,* 546, 1950). *Textile Research J. Abstracts, 21,* A102 (1951).

An anti-parasitic product, e.g., DDT, is incorporated in a colloidal gel of a sol. alignate. Fabrics, etc. are impregnated with this gel, which becomes insol., and thus retains the activity of the insecticide for several years. An example is given of its prepn. and of its application to a carpet.

Advertisers' Index

	PAGE
American Can Co.	1
Aseptic-Thermo Indicator Co.	18
Brewers Yeast Council	22
Distillation Products Industries	7
Dodge & Olcott, Inc.	8
Dow Corning Corp.	17
Firmenich, Inc.	3rd cover
Florasynth Laboratories, Inc.	19
Food Development Laboratory	24
Food Machinery & Chemical Corp.	9
Food Research Laboratories, Inc.	24
Fritzsche Bros., Inc.	24
General Foods Corp. (Diamond Crystal Salt)	21
The Griffith Laboratories, Inc.	4th cover
The Huron Milling Co.	20
Johns-Manville	12
LaWall & Harrisson	22
Magnus, Mabee & Reynard, Inc.	2
Minneapolis-Honeywell Regulator Co. (Industrial Division)	14-15
The Pfaudler Co.	2nd cover
Schwarz Laboratories, Inc.	22
Foster D. Snell, Inc.	24
Sterwin Chemicals, Inc.	13
U. S. Treasury	5
van Ameringen-Haebler, Inc.	11

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For further details, see "Methods of Sieve Analysis With Particular Reference to Bone Char" by V. R. Dietz and F. G. Carpenter, Research Paper RP 2143, Research Nat. Bur. Standards, October 1950.

A limited number of the calibrated glass sphere mixtures are available, at $10.00 each, from J. M. Brown, Secretary, Bone Char Research Project, Inc., c/o Revere Sugar Refinery, 333 Medford St., Charlestown 29, Mass. [From *Aminco Lab. News,* 8 (5) 6 (1951) September.]

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POSITION WANTED: Food Technologist, M.S. in Bacteriology, B.A. in Zoology. Excellent background chemistry and bacteriology of foods. 1½ yrs. experience in research and development in food industry. Some supervisory experience. Desires experience and opportunity in quality control, research and development or technical sales. REPLY BOX 182, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

WANTED: Food Technologist for research staff of manufacturer quality food and flavors of ice cream and dairy trade. Located in Midwest. In reply give complete resumé of education, experience and salary desired. REPLY BOX 183, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

WANTED: Young Food Technologist to work in Chicago area. Work consists of contacting canneries. Opportunity for development in technical sales. Give full details of education, age and salary in first letter. REPLY BOX 184, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

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New York State Agricultural Experiment Station
Geneva, New York

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CONTENTS

PHYSICS AND INSTRUMENTATION. Nelson Gildersleeve . . . 41

RADIOGRAPHY APPLIED TO GRAIN AND SEEDS. Max Milner, Milford R. Lee, and Robert Katz 44

THE QUALITY OF SAUERKRAUT PRESERVED IN TIN AND GLASS. Carl S. Pederson and Willard B. Robinson 46

UTILIZATION OF INSTRUMENTATION IN THE WET MILLING INDUSTRY. H. C. Frost 50

FROZEN COOKED RICE. II. BROWN RICE. Mildred M. Boggs, Alice C. Ward, Catherine N. Sinnott, and E. B. Kester . 53

THE EFFECT OF CLEANING ON THE FLAVOR AND INTERIOR QUALITY OF SHELL EGGS. Richard H. Forsythe 55

RAPID METHOD FOR MOISTURE IN FRUITS AND VEGETABLES BY OXIDATION WITH DICHROMATE. I. POTATOES AND PEAS. Herbert F. Launer and Yoshio Tomimatsu 59

ROLE OF FOOD INDUSTRY IN THE PRODUCTION OF NEW PRODUCTS FOR NAVAL SUBSISTENCE. Lieutenant Commander J. A. Corrick, Jr., S.C., U.S.N. Lendal H. Kotschevar, and Arthur C. Avery 64

THE CONSUMER'S REACTION TOWARD THE FOOD INDUSTRY AND ITS PRODUCTS. Mrs. Raymond W. Gregory 66

PRACTICAL DETERMINATION OF SIZE DISTRIBUTION OF SUSPENDED PARTICLES IN MACERATED TOMATO PRODUCTS. Lillian B. Kimball and Z. I. Kertesz 68

PEANUT BUTTER. I. ROASTING, COOLING, BLANCHING, AND PICKING OF PEANUTS. R. K. Willich, A. S. Hall, N. J. Morris, and A. F. Freeman 71

SOME FACTORS AFFECTING STABILITY OF CHICKEN FAT. H. J. Phillips and I. L. Williams 74

EFFECT OF A DROP IN RETORT TEMPERATURE UPON THE LETHALITY OF PROCESSES FOR CONVECTION HEATING PRODUCTS. John E. W. McConnell 76

BOOK REVIEW 79

REGIONAL SECTION NEWS *4*

SELECTED ABSTRACTS *14*

Authors of papers intended for publication in FOOD TECHNOLOGY should request from the editorial office a copy of the booklet, entitled "Information and suggestions to authors." Manuscripts submitted for publication in FOOD TECHNOLOGY should follow the style described in this booklet.

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Regional Section News

NORTHERN CALIFORNIA SECTION

The Section held its Annual Meeting on December 6 in the Western Regional Research Laboratory, Albany, Calif., when the following papers were given at the all-day session:

"Color evaluation of food purees using black and white photography" by Dave Eolkin, Gerber Products Co., Oakland, Calif.

"Operational quality control" by E. N. Higgins, H. J. Heinz Co., Tracy, Calif.

"Chlorination studies on re-used water in pea canneries" by W. A. Mercer, Western Branch Laboratory, National Canners Association, Berkeley.

"Potato granules" by R. L. Olson, Western Regional Research Laboratory, Albany, Calif.

"Packaging of powdered milk" by John B. Shields, Golden State Co. Ltd., San Francisco, Calif.

"Vitamin analysis of California figs" by Alice P. Hall, University of California, Berkeley.

"A new theory of oxidation" by Frank McGuggin, McGuggin Laboratories, Fresno, Calif.

"Frozen apple juice concentrate" by W. F. Talburt and L. H. Walker, Western Regional Research Laboratory, Albany.

"Food preferences of pre-army age California boys" by Barbara M. Kennedy, University of California, Berkeley.

"Observations on the use of pectic enzymes" by W. V. Cruess, R. O'Neal and J. Kruezer, University of California, Berkeley.

"The chemistry of shell egg deteriorations" by R. E. Feeney and L. R. MacDonnell, Western Regional Research Laboratory, Albany.

"Identification of fats in various processed foods" by Norman F. Johnston, Stanford Research Laboratory, Stanford, Calif.

Following the papers, a tour was made of the new Western Branch Laboratory of the National Canners Association, 1950 6th Street in Berkeley. The dinner session was held in the Berkeley Women's City Club and the guest speaker was Dr. J. R. Vickery, Chief of the Division of Food Preservation and Transport, Commonwealth Scientific and Industrial Research Organization, Sydney, Australia. He took for his subject: Food preservation research in Australia.

At time of going to press, a list of newly elected officers had not been received by your Regional Section News editor.

FLORIDA SECTION

On December 12 the Section held a dinner meeting at Cones Dairy, Plant City, Fla., following which a business meeting was held and then a visit made to the Southland Frozen Foods plant, packers of frozen vegetable and fruit products. The visit was arranged by Gray Singleton, Director of Research of Southland Frozen Foods, Inc.

WESTERN NEW YORK SECTION

"Proteins as enzymes" was the subject of a paper given by Dr. W. D. Langley, Professor of Biochemistry at the University of Buffalo Medical School, when he addressed the January 8th meeting of the Western New York Section at the New York State Institute of Applied Arts and Sciences in Buffalo.

(Continued on page 8)

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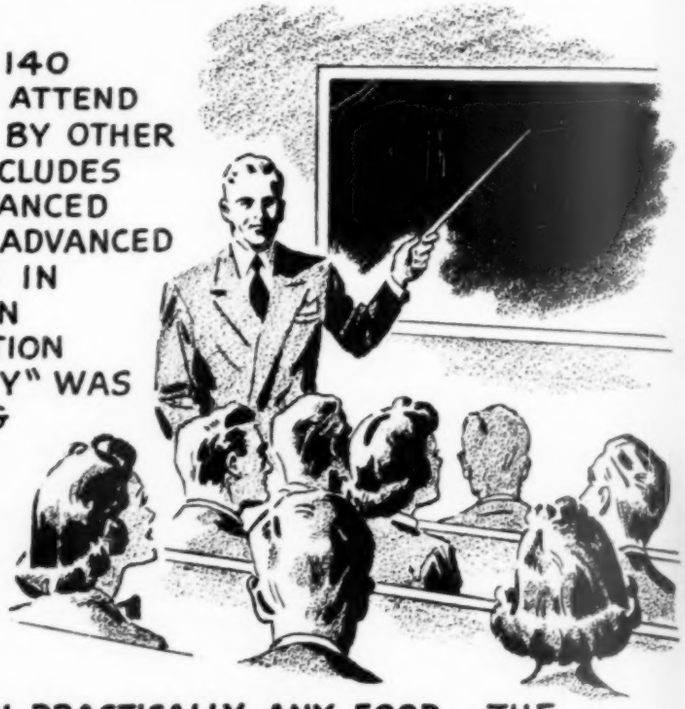

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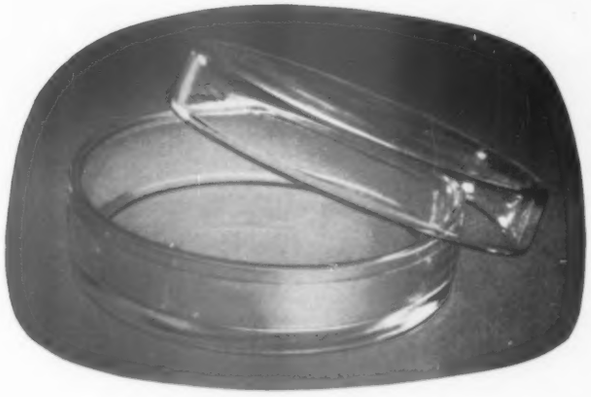

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CONTENTS

PHYSICS AND INSTRUMENTATION. Nelson Gildersleeve . . . 41

RADIOGRAPHY APPLIED TO GRAIN AND SEEDS. Max Milner, Milford R. Lee, and Robert Katz 44

THE QUALITY OF SAUERKRAUT PRESERVED IN TIN AND GLASS. Carl S. Pederson and Willard B. Robinson 46

UTILIZATION OF INSTRUMENTATION IN THE WET MILLING INDUSTRY. H. C. Frost 50

FROZEN COOKED RICE. II. BROWN RICE. Mildred M. Boggs, Alice C. Ward, Catherine N. Sinnott, and E. B. Kester . 53

THE EFFECT OF CLEANING ON THE FLAVOR AND INTERIOR QUALITY OF SHELL EGGS. Richard H. Forsythe 55

RAPID METHOD FOR MOISTURE IN FRUITS AND VEGETABLES BY OXIDATION WITH DICHROMATE. I. POTATOES AND PEAS. Herbert F. Launer and Yoshio Tomimatsu 59

ROLE OF FOOD INDUSTRY IN THE PRODUCTION OF NEW PRODUCTS FOR NAVAL SUBSISTENCE. Lieutenant Commander J A. Corrick, Jr., S.C., U.S.N. Lendal H. Kotschevar, and Arthur C. Avery 64

THE CONSUMER'S REACTION TOWARD THE FOOD INDUSTRY AND ITS PRODUCTS. Mrs. Raymond W. Gregory 66

PRACTICAL DETERMINATION OF SIZE DISTRIBUTION OF SUSPENDED PARTICLES IN MACERATED TOMATO PRODUCTS. Lillian B. Kimball and Z. I. Kertesz 68

PEANUT BUTTER. I. ROASTING, COOLING, BLANCHING, AND PICKING OF PEANUTS. R. K. Willich, A. S. Hall, N. J. Morris, and A. F. Freeman 71

SOME FACTORS AFFECTING STABILITY OF CHICKEN FAT. H. J. Phillips and I. L. Williams 74

EFFECT OF A DROP IN RETORT TEMPERATURE UPON THE LETHALITY OF PROCESSES FOR CONVECTION HEATING PRODUCTS. John E. W. McConnell 76

BOOK REVIEW 79

REGIONAL SECTION NEWS *4*

SELECTED ABSTRACTS *14*

Authors of papers intended for publication in FOOD TECHNOLOGY should request from the editorial office a copy of the booklet, entitled "Information and suggestions to authors." Manuscripts submitted for publication in FOOD TECHNOLOGY should follow the style described in this booklet.

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Regional Section News

NORTHERN CALIFORNIA SECTION

The Section held its Annual Meeting on December 6 in the Western Regional Research Laboratory, Albany, Calif., when the following papers were given at the all-day session:

"Color evaluation of food purees using black and white photography" by Dave Eolkin, Gerber Products Co., Oakland, Calif.
"Operational quality control" by E. N. Higgins, H. J. Heinz Co., Tracy, Calif.
"Chlorination studies on re-used water in pea canneries" by W. A. Mercer, Western Branch Laboratory, National Canners Association, Berkeley.
"Potato granules" by R. L. Olson, Western Regional Research Laboratory, Albany, Calif.
"Packaging of powdered milk" by John B. Shields, Golden State Co. Ltd., San Francisco, Calif.
"Vitamin analysis of California figs" by Alice P. Hall, University of California, Berkeley.
"A new theory of oxidation" by Frank McGuggin, McGuggin Laboratories, Fresno, Calif.
"Frozen apple juice concentrate" by W. F. Talburt and L. H. Walker, Western Regional Research Laboratory, Albany.
"Food preferences of pre-army age California boys" by Barbara M. Kennedy, University of California, Berkeley.
"Observations on the use of pectic enzymes" by W. V. Cruess, R. O'Neal and J. Kruezer, University of California, Berkeley.
"The chemistry of shell egg deteriorations" by R. E. Feeney and L. R. MacDonnell, Western Regional Research Laboratory, Albany.
"Identification of fats in various processed foods" by Norman F. Johnston, Stanford Research Laboratory, Stanford, Calif.

Following the papers, a tour was made of the new Western Branch Laboratory of the National Canners Association, 1950 6th Street in Berkeley. The dinner session was held in the Berkeley Women's City Club and the guest speaker was Dr. J. R. Vickery, Chief of the Division of Food Preservation and Transport, Commonwealth Scientific and Industrial Research Organization, Sydney, Australia. He took for his subject: Food preservation research in Australia.

At time of going to press, a list of newly elected officers had not been received by your Regional Section News editor.

FLORIDA SECTION

On December 12 the Section held a dinner meeting at Cones Dairy, Plant City, Fla., following which a business meeting was held and then a visit made to the Southland Frozen Foods plant, packers of frozen vegetable and fruit products. The visit was arranged by Gray Singleton, Director of Research of Southland Frozen Foods, Inc.

WESTERN NEW YORK SECTION

"Proteins as enzymes" was the subject of a paper given by Dr. W. D. Langley, Professor of Biochemistry at the University of Buffalo Medical School, when he addressed the January 8th meeting of the Western New York Section at the New York State Institute of Applied Arts and Sciences in Buffalo.

(Continued on page 8)

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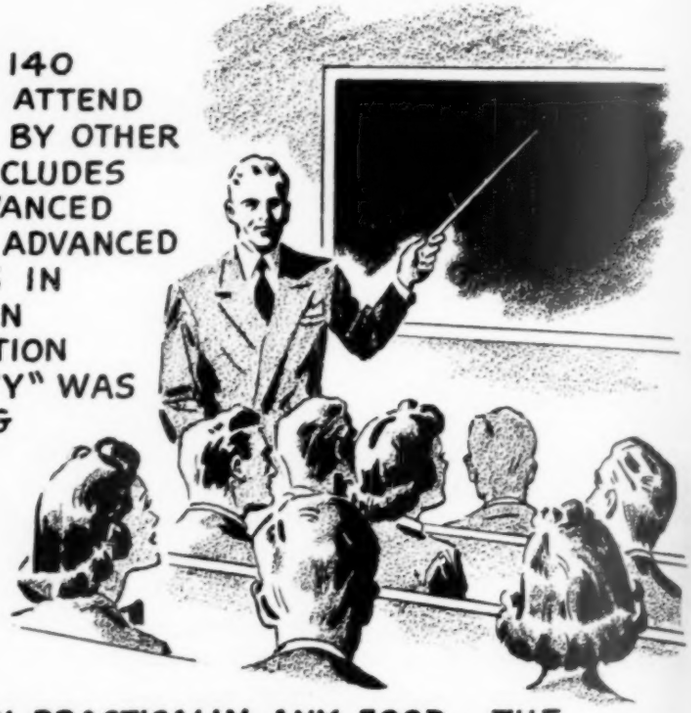

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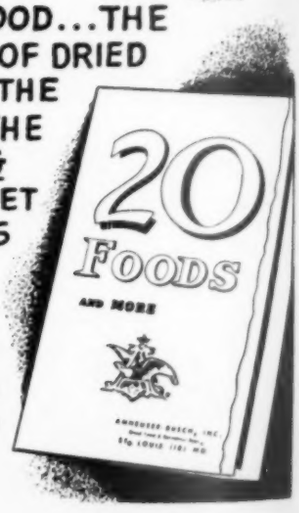

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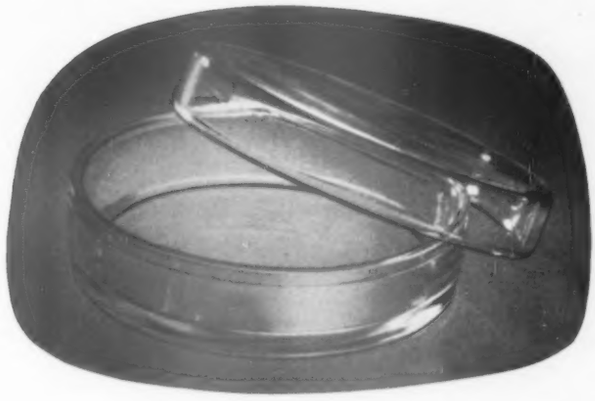

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Regional Section News

(Continued from page 4)

It has been proposed that the national conference of the IFT be held in Buffalo, possibly in 1956, but at time of writing a definite decision had not been learned.

SOUTHERN CALIFORNIA SECTION

The December meeting of the Southern California Section was held Wednesday, December 19, 1951 at the Roger Young Auditorium at Los Angeles. A delicious prime rib dinner was enjoyed by all. In fact, through the generosity of the Roger Young Management, second portions were enjoyed by a substantial number of the members.

The speaker of the evening was Mr. Clay Hopper, Vice President of the Vegetable Oil Products Co., Wilmington, California. Mr. Hopper has had considerable experience in the refining of vegetable oils and the use of such products in the food industry. His talk was extremely interesting and timely as shown by the large number of questions asked during the discussion following his talk.

The annual all-day meeting is scheduled for Saturday, February 16, 1952 at the Huntington Hotel in Pasadena. The theme of the all-day meeting will be "The Importance of Chemicals for Better Foods" and will include sections on Insecticides and Pesticides, Antioxidants, Emulsifiers and Stabilizers, and Preservatives.

PUGET SOUND SECTION

The Northwestern Glass Co., Seattle, was host to the Puget Sound Section for the October meeting. Under the direction of Mr. G. Roessler, Superintendent, a plant tour was arranged to include a most complete and instructive review of the mechanics and technology of the manufacture of amber and flint glass; highlighting the company's long development of electric furnaces for processing. All members in attendance truly "looked through glass" to appreciate the success of a developmental program initiated in 1945, under the direction of Mr. S. Campbell, President. These developments lead to the design of two electric glass furnaces which increased production of a superior quality amber glass to meet discriminating industrial demands. In conclusion the company was proud to show how their advances are enabling them to combine electric heat with oil-fired furnaces for better quality and increased production. The meeting was one of the most fascinating this Section has had the pleasure of attending.

PERSONNEL

B. S. Clark, formerly Director of Research of the American Can Company, has been appointed Scientific Director of Research and Development.

Ernest C. Crocker of Arthur D. Little, Inc., Cambridge, Mass., addressed members of eight midwestern sections of the American Chemical Society between December 3 and 14 on the subject: "The Chemistry of Flavors and Odors." He emphasized the necessity of both chemistry and psychology in flavor work, pointing out that food people must become psychologists in part to deal with flavor sensations and their interpretation. He spoke before sections of the ACS in Urbana and Quincy, Ill.; Columbia and Joplin, Mo.; Wichita and Manhattan, Kan.; and Tulsa and Bartlesville, Okla.

Louis A. King has been appointed Director of the Department of Sanitation of the American Institute of Baking of Chicago, Ill. Mr. King is a graduate of Mississippi State College and before joining the AIB was at the University of Vermont and with the Federal Food and Drug Administration.

Antonio Lopez-Matas has been elected to become Secretary of the Chilean Society of Nutrition. Dr. Lopez-Matas is Head of the Food Products Department of the Instituto Sanitas y Anilinas at Santiago, Chile.

Charles D. Lowry, Jr., until recently with the Universal Oil Products Co., formed with Harold E. Bode the new consulting firm Bode-Lowry and Associates, Chicago, Ill. Dr. Lowry studied at Northwestern and Harvard Universities and at the University of Munich and was for two years with the American Meat Institute before joining Universal Oil where he served for twenty-three years.

Carlos Mills joined Kingan and Co. of Minneapolis, Minn. as Food Technologist. He was formerly with the Food Technology Department of the College of Agriculture of the University of Georgia at Athens, Georgia.

James C. Palmer, Chief Chemist of the Food and Drug Administration, Seattle, Wash., has been transferred to the Food Division of the same agency in Washington, D. C. Because of his many years of experience and association with spoilage relating to products of commerce, he will be engaged in work on research problems concerning the responsible factors in food spoilage. A charter member of the Puget Sound Section, he succeeded in establishing a progressive and cooperative unity between the agency and industry.

R. W. Pilcher, formerly Associate Director of the Research and Technical Department of the American Can Co. of Chicago, Ill., has been appointed as Director of Research.

D. F. Sampson, formerly Chief of the Container Section of the Research and Technical Department of the American Can Co. of Chicago, Ill., has been appointed Associate Director of Research. Dr. Sampson is an Associate Editor of Food Technology.

FUTURE DATES FOR FOOD TECHNOLOGISTS

March 3-7	National Association of Frozen Food Packers, Hotel Stevens, Chicago, Ill.
March 31-April 3	Division of Agricultural and Food Chemistry, American Chemical Society, Spring Meeting, Milwaukee, Wis.
April 20-25	American Association of Cereal Chemists, National Convention, Adolphus Hotel, Dallas, Texas.
April 28-30	American Oil Chemists' Society, Spring Meeting, Shamrock Hotel, Houston, Texas.
June 8-12	**Institute of Food Technologists, Twelfth Annual Meeting, Grand Rapids, Mich.**

(Information concerning future dates of national and international meetings, conventions and exhibits of interest to food technologists should be sent to the editorial office.)

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GRAND RAPIDS, MICHIGAN, HOST TO THE 1952 ANNUAL MEETING OF THE IFT

Grand Rapids, Michigan, the host city for the forthcoming June Annual Meeting, is today acknowledged as having the best facilities in the nation to properly house, feed and accommodate convention groups from 100 to 5,000.

Fifty years of entertaining stand behind the city, and yet Grand Rapids remains a fresh and inviting travel experience. Founded as an Indian trading post in 1826, the city is laid out in the valley of the Grand River and is overrun with scenic hills and quiet streams.

Although metropolitan in character, the city is still vigorously growing. It is the second largest city in Michigan, situated 150 miles northwest of larger Detroit. Thirty miles to the west lies breezy Lake Michigan, whose pure fresh water services the city.

Tagged as the Convention Crossroads of America and as the Gateway to the Summer Playground of the Nation, Grand Rapids is but an hour's drive to any of 250 lakes and trout streams. Novel sand dunes are also a part of the region. Ten minutes' drive will take you to any of ten golf courses that welcome visitors. Bathing beaches and pools, tennis and badminton courts, dance pavilions, theaters, excellent restaurants, smart clubs and stage shows afford superb amusement around the city.

But the truest and most outstanding characteristic of this Western Michigan city is summed up in the title—"Furniture Capital of America." Grand Rapids' furniture industry is more than 100 years old and is based originally on the fine hardwoods in the Grand River valley. The skill of expert craftsmen brought rapid growth to the industry along with recognized leadership in style, design and workmanship.

Today there are about 80 factories devoted exclusively to furniture. Each year buyers from all over the world visit the city's exposition buildings and factory showrooms to select fine furniture.

Conventioneers will have an opportunity to view examples of this furniture art by visiting the Furniture Museum, the only one of its kind in the world. Located in the former home of one of Michigan's "Lumber Barons," the displays include original masterpieces, excellent samples of period reproductions, and the finest modern creations of the world's leading designers and craftsmen. One exhibit shows furniture manufacture from the forest to the finished product.

In the House of Today and the Apartment of Today, the latest furniture is displayed in settings selected by a committee of nationally known decorators. The museum is open every day including Sunday from two to five in the afternoon.

Approximately 700 other manufacturing concerns are located in Grand Rapids in addition to woodworking firms. The city's industries include metal working, graphic arts, baking and food products, paper products, gypsum mining and products, radio and electrical manufacturing, chemicals and textiles. Its large food industry makes Grand Rapids a center for brewing, bottling and meat packing.

The white-pillared Grand Rapids Art Gallery is also an outstanding attraction of the city. Built in 1844, the gallery boasts a fine permanent collection which is augmented periodically by many fine loan collections and special showings. It is open from 10 A.M. to 5 P.M. daily and from 2 P.M. to 5 P.M. Sundays and Holidays.

For sportsmen and nature lovers, the Public Museum should be of interest. It exhibits 80 kinds of Michigan fish; also mammals, birds, reptiles, amphibians and wild flowers. One section tells the story of Michigan lumbering. Permanent exhibits of special interest are the halls of Michigan pioneer life, Oriental life, Pacific Island cultures and the history of timepieces.

The massive Civic Auditorium, which will house the convention, is a $1,500,000 structure designed and built especially for conventions and expositions. It is a municipal enterprise, entirely owned by the citizens of Grand Rapids. The auditorium has a fine central location in the heart of the hotel and business district. The Pantlind Hotel is directly across the street and connected to the auditorium by a subway corridor. Two other modern hotels, the Rowe and the Morton, are less than two blocks distant. Theaters, amusements and department stores are equally convenient.

Grand Rapids is served by four railroads which enter the city from 12 different directions. It also has bus and airline connections with the nation's major systems.

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An award of $100.00, designated as the SAMUEL CATE PRESCOTT AWARD, is to be made by the Northeast Section of the Institute of Food Technologists to the student presenting for this competition the best written account of a research project in the field of food technology.

Those elegible for the competition include all student members of the Institute of Food Technologists in good standing or persons who were formerly student members but who attained their bachelors' degrees no more than 12 months previously.

To be included in the present year, qualified competitors are required to submit their written reports in this competition to the Institute of Food Technologists, 176 West Adams St., Chicago 3, Illinois, previous to August 25, 1952.

1952 IFT DUES

Membership dues amounting to $7.50 per year (student dues $2.50) are due and payable January 1st. If not paid during the first sixty days of the calendar year, the member must be suspended and his journal subscription terminated. Dues payments should be sent to:

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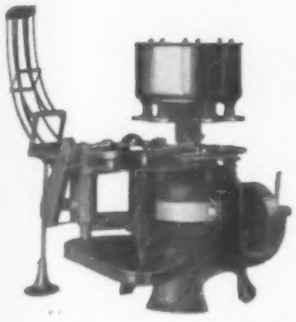

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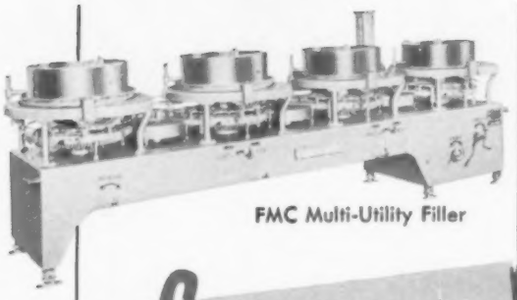

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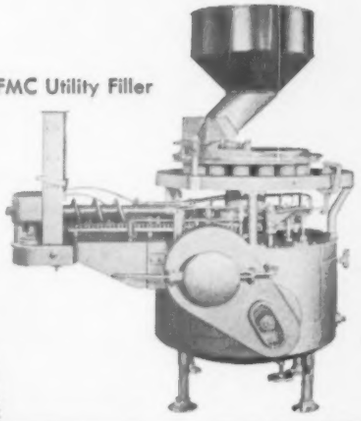

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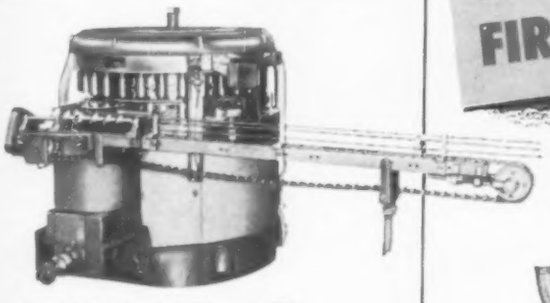

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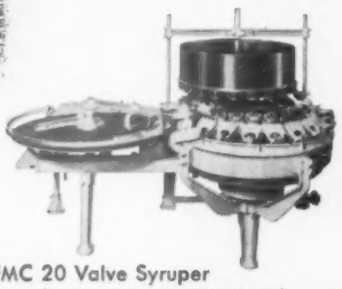

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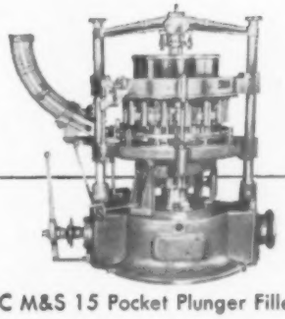

FMC M&S 15 Pocket Plunger Filler

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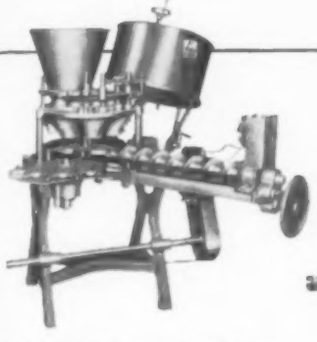

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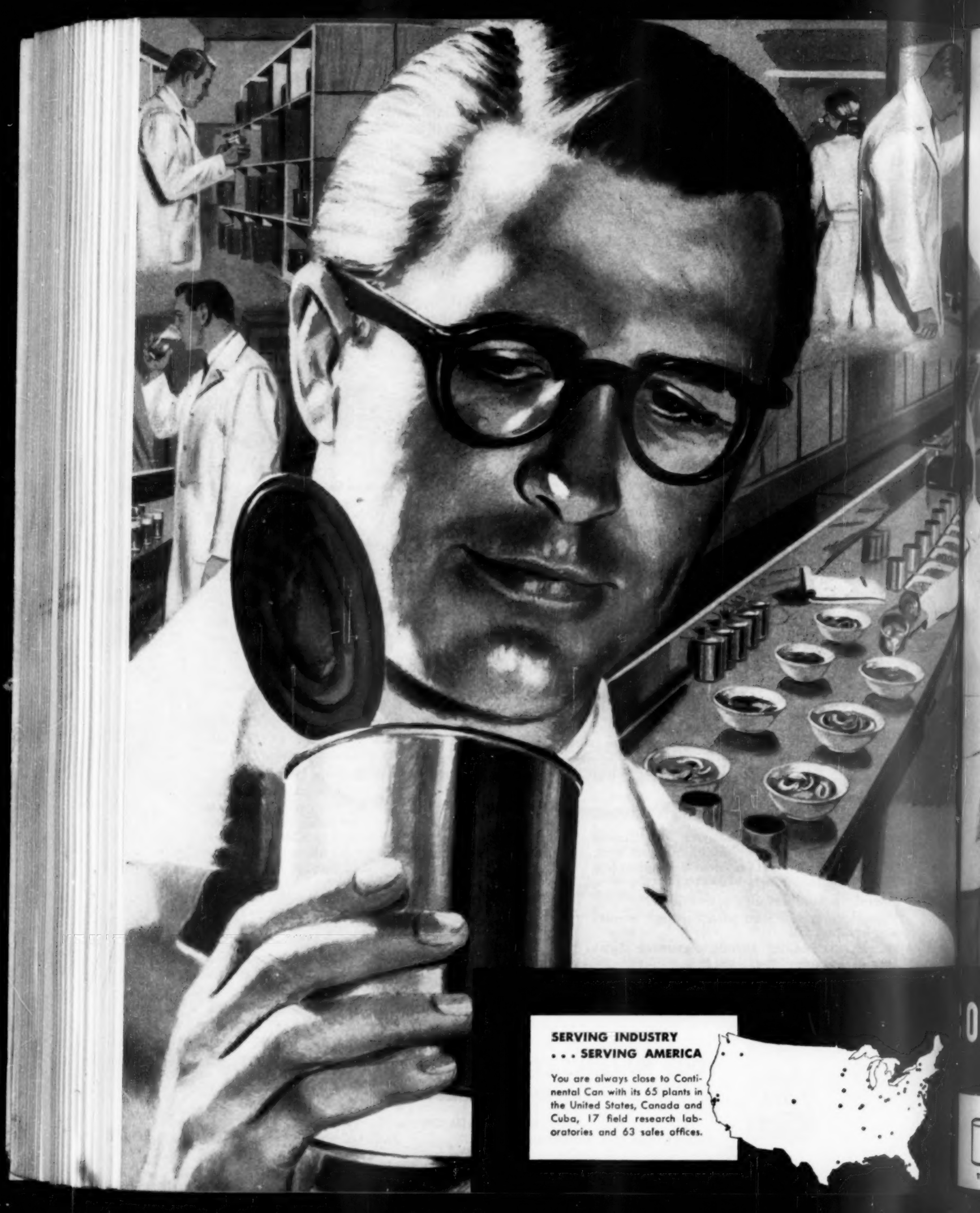
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Selected Abstracts[a]

ANALYTICAL METHODS

Paper chromatography of volatile acids.

KENNEDY, E. P., AND BARKER, H. A. *Anal. Chem., 23,* 1033-4 (1951).

C_2 to C_6 acids converted to ammonia salts, chromatographed on No. 1 Whatman paper were treated with oxalic acid. 1% NH_4OH in 95% ethanol was used as developing solvent. Acids were located with bromophenol blue-citric acid indicator.

Paper partition chromatography of the free amino acids in American cheddar cheese.

KOSIKOWSKY, F. V. *J. Dairy Sci., 34,* 228-34 (1951).

Paper partition chromatography was successfully used in the analyses of water-sol. protein decompn. products of a number of commercial cheddar cheeses. The cheeses were found to contain leucines, methionine, valine, alanine, arginine, lysine, threonine, glycine, asparagine, glutamic acid, aspartic acid, phenylalanine, proline, tyramine, tyrosine, α-amino-*n*-butyric acid, serine, cystine, and probably histidine and γ-aminobutyric acid.

The liberation of free amino acids in raw and pasteurized milk cheddar cheese during ripening.

KOSIKOWSKY, F. V. *J. Dairy Sci., 34,* 235-41 (1951).

The rate of production of free amino acids, amides, and amines in American cheddar cheese from the date of manuf. over a ripening period of 180 days at 60° F. was studied using paper partition chromatography. The compds. were detd. using a rough quant. procedure.

The copper of ascorbic acid oxidase. Experiments with an ion exchange resin.

JOSELOW, M., AND DAWSON, C. R. *J. Biol. Chem., 191,* 1-10 (1951).

A cation exchange column has been applied successfully to the quant. sepn. of ionic copper from solns. of ascorbic acid oxidase. It has been shown that such a sepn. can be effected without any measurable damage to the activity of the enzyme. Evidence has been presented to support that, under physiol. conditions, the bond between the copper and protein in the enzyme is non-dissociable, and differs in this respect from whatever type of linkage may result, if any, when ionic copper is added to ascorbic acid oxidase. The inactivation of ascorbic acid oxidase occurring during catalytic action has been confirmed. It has been shown that this inactivation cannot be attributed to the loss of copper from the enzyme in an ionic or other dialyzable form.

Report on uric acid in cereal products.

BARRY, H. C. *J. Assoc. Offic. Agric. Chemists, 34,* 520-3 (1951).

Uric acid content of cereal products may be used as an index of filth in the food. The colorimetric method of Fearon for detg. uric acid after the acid is extd. from the cereal with quinaline is proposed.

Report on decomposition of fruits and fruit products. Galacturonic acid.

WINKER, W. O. *J. Assoc. Offic. Agric. Chemists, 34,* 506-12 (1951).

Galacturonic acid provides a valuable criterion of amt. of decompn. in fruit. A tentative method for detn. of galacturonic acid involves absorption of the acid on ion-exchange resins. The galacturonic acid is detd. by reaction with naphthoresorcinol in hydrochloric acid soln.

Estimation of antioxidants in lard and shortening.

MAHON, J. H., AND CHAPMAN, R. A. *Anal. Chem., 23,* 1116-20 (1951).

Because mixts. of antioxidants are now widely used in the stabilization of lard and shortening, methods for the detn. of combinations of antioxidants are required. Procedures have been developed for the extn. and colorimetric detn. of propyl gallate, butylated hydroxyanisole, nordihydroguaiaretic acid, and tocopherol in lard and shortening. The procedure permits the detn. of all combinations of these four antioxidants except when propyl gallate and nordihydroguaiaretic acid are present in the same sample. The lower limits of the detn. with a high degree of accuracy, are propyl gallate 0.003%, butylated hydroxyanisole 0.005%, nordihydroguaiaretic acid 0.005%, and tocopherol 0.015%. However, satisfactory results have been obtained at much lower levels. Recoveries ranged from 96.4% for nordihydroguaiaretic acid in combination with butylated hydroxyanisole, to 98.4% for nordihydroguaiaretic acid alone. These procedures permit accurate detn. of combinations of antioxidants in lard and shortening, as well as study of the relative rates of destruction of individual antioxidants in mixts. in lard and shortening.

BIOLOGICAL SCIENCES

BIOCHEMISTRY

Effect of feeding penicillin on the life cycle of the chick.

ELAM, J. F., GEE, L. L., AND COUCH, J. R. *Proc. Soc. Exptl. Biol., 77,* 209-13 (1951).

The feeding of penicillin stimulated the growth of birds on an all-vegetable-protein diet. Injection of the antibiotic into birds fed basal diet stopped the mortality. Hatchability of eggs from pullets on basal diet was nil, whereas those injected with B_{12} gave eggs within the normal range (72%). Feeding penicillin caused a significant increase in total no. of intestinal microorganisms and a marked increase in the penicillin resistant microorganisms in the intestinal tract.

Directed interesterification in glycerides. III. The synthesis of single-fatty acid 1, 3-diglycerides.

BAUR, F. J., AND LANGE, W. *J. Am. Chem. Soc., 73,* 3926-8 (1951).

A method for the synthesis of single-fatty acid symmetrical diglycerides has been described. The process involves the use of low-temp. directed interesterification in which symmetrical diglycerides are preferentially crystd. from statistically distributed catalyzed single-fatty acid triglyceride-triacetin-glycerol mixts. The method is useful in the prepn. of symmetrical diglycerides derived from single fatty acids with melting point about 20°. A new diglyceride, 1, 3-dibehenin, has been prepd.

Enzymatic synthesis of amylopectin.

NUSSENBAUM, S., AND HASSID, W. Z. *J. Biol. Chem., 190,* 173-83 (1951).

The linear amylase fraction of starch can be transformed with Q enzyme from potatoes to a branched polysaccharide possessing the chem. and biochem. properties of amylopectin. The synthetic product is sol. in water, does not retrograde from soln., and stains purple-red with iodine. By osmotic pressure measurements it has a mol. wt. of 54,000 and an av. chain length of 21 glucose residues per end-group by the periodate oxidation method. The Q enzyme, regarded as a trans-glycosidase, is apparently capable of splitting 1, 4-glucosidic linkages in amylase and exchanging them for 1, 6 linkages for amylopectin synthesis.

The question of the branching enzyme in potatoes.

BECKMANN, C. O., AND ROGER, M. *J. Biol. Chem., 190,* 467-80 (1951).

It has been verified that the prepn. designated Q enzyme by Haworth, Peat, and Bourne converts amylose to a product which stains red with iodine and which is only partially converted to maltose by β-amylase. The Q prepn. has been shown to retain this property after treatment with 3.6 *M.* potassium hydroxide, as well as in the presence of 0.02 *M.* iodine and other reagents.

(Continued on page 16)

[a] These Selected Abstracts are made available to FOOD TECHNOLOGY through the cooperation of Associate Editor H. A. Campbell and the General Foods Corporation of New York, N. Y. The abbreviations found in these abstracts are similar to those used by Chemical Abstracts.

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Abstracts

(Continued from page 14)

Effect of ascorbic acid on experimental hypertension.

HEROUX, P. O., AND DUGAL, L. PAUL. *Can. J. Med. Sci., 29,* 164-75 (1951).

In previously reported observations, it was shown that (a) ascorbic acid, given in large doses, had a hypotensive effect on normal blood pressure, (b) the initial hypotension, due to sudden exposure to cold, was prevented by large doses of ascorbic acid, (c) the hypertension encountered upon long exposures to cold was lowered by ascorbic acid. The present paper confirms the last result and also shows that actually ascorbic acid has a hypotensive action on exptl. hypertension obtained by the two following ways: (1) excess of sodium chloride in drinking water and (2) renal compression. The hypertension and adrenal hypertrophy caused by a long exposure to cold regress when the animals are brought back to normal temp. In its initial phase, the exptl. renal hypertension is lowered by ascorbic acid but not in its chronic phase.

Acute and chronic toxicity of potassium acid saccharate.

AMBROSE, A. M. *J. Am. Pharm. Assoc., 40,* 277-9 (1951).

The acute oral or intraperitoneal toxicity of potassium acid saccharate is extremely low. No toxic effects or fatalities were observed in rats receiving as much as 2 g. per kg. in a single dose of a soln. of potassium acid saccharate previously neutralized to reduce irritation. Rats fed diets contg. 2% or less potassium acid saccharate for approx. 210 days showed no untoward effect as judged by general appearance, growth, the amt. of food consumed, mortality, organ weights, and microscopical examn. of visceral organs.

Toxicity studies on alkyldimethylbenzylammonium chloride in rats and in dogs.

ALFREDSON, B. V., STIEFEL, J. R., THORP, JR., FRANK, BATEN, W. D., AND GRAY, M. L. *J. Am. Pharm. Assoc., 40,* 263-67 (1951).

Results are presented concerning the effects of alkyldimethylbenzylammonium chloride (Roccal) when fed in the diets of rats and dogs and when given in single doses by stomach tube to rats. Rats were fed for a 2-year period in one expt. and for 4 months in another. Dogs were fed the test agent for 15 weeks. The results of these studies show no demonstrable evidence of toxicity for alkyldimethylbenzylammonium chloride when fed in concns. of 0.25% or less in the diet of the rats and 0.12% or less in the diet of the dogs. The acute LD_{50} of this compd. in rats, as detd. by single oral dosages, was found to be 234.3 ± 26.5 mg. per kg. body weight.

Chronic toxicity studies on methylcellulose in rats.

BAUER, R. O., AND LEHMAN, A. J. *J. Am. Pharm. Assoc., 40,* 257-60 (1951).

A standard diet of 5% methylcellulose fed to rats for 32 weeks (averaging 690-775 mg. per kg. per day per rat during this period) had no deleterious effect on growth, and significantly increased dietary intake. Also, it neither inhibited reproduction nor left evidence of pathologic change in the tissue. 50% of the diet replaced by methylcellulose significantly depressed growth through nutritional want. Methylcellulose is not hydrolyzed to cellulose and methanol in the intestinal tract of rats to any detectable extent. Methylcellulose per se does not appear to be absorbed from the intestinal tract of rats.

How poisonous is mercury?

LAWRENCE, J. B. *Chem. Eng. News, 29,* 3529-31 (1951).

Precautions to be taken in using, plus methods of purification and recovering spilled Hg. are given.

MEDICINE

Relation of protein nutrition to the healing of experimental wounds.

WILLIAMSON, M. B., MCCARTHY, T. H., AND FROMM, H. J. *Proc. Soc. Exptl. Biol. Med., 77,* 302-05 (1951).

There appears to be no relation between the amt. of protein nitrogen fed or retained by rats and the rate of healing of

(Continued on page 24 following technical papers)

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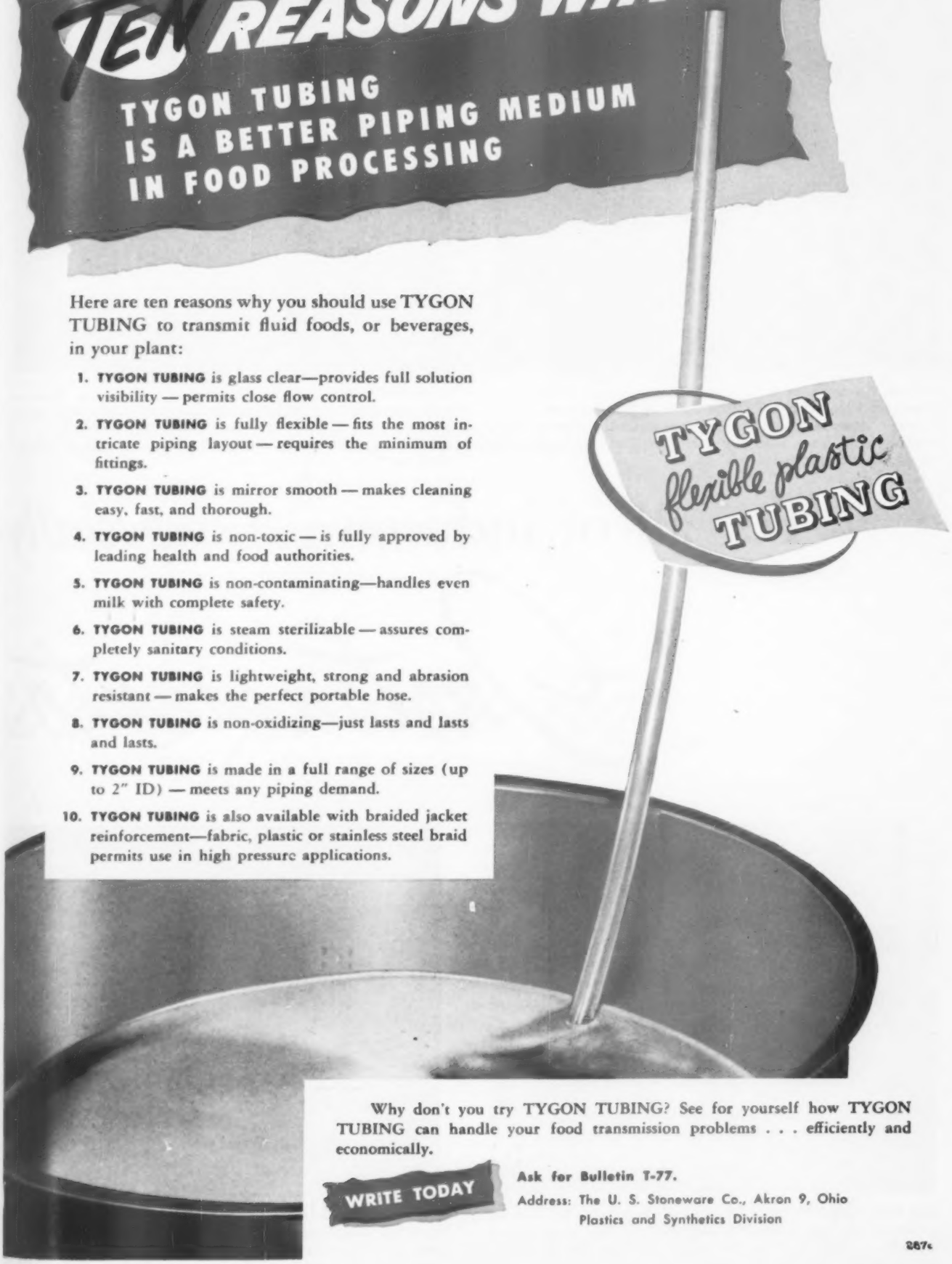

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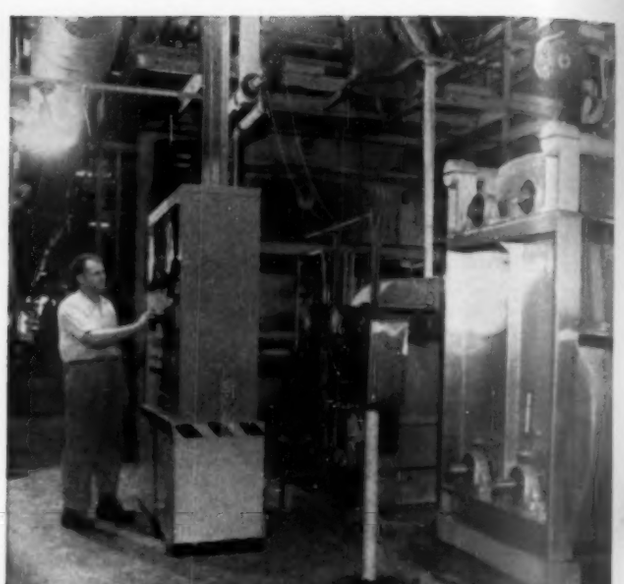

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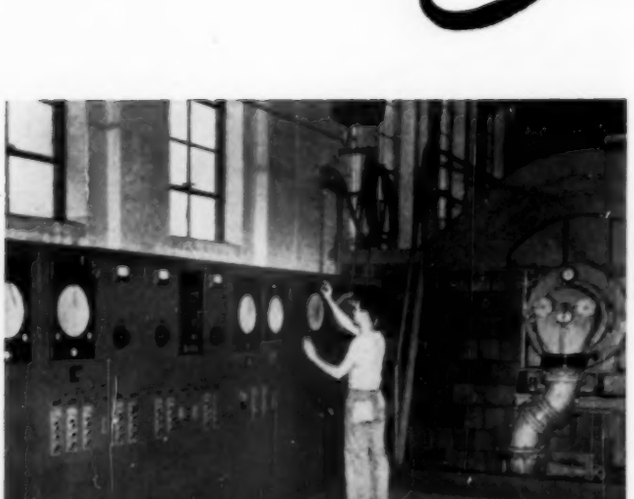

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Abstracts

(Continued from page 16 preceding technical papers)

wounds. It is suggested that the amt. of sulfur retained in excess over that utilized for normal tissue protein synthesis is an important factor in rate of healing of wounds.

Some physiological aspects of aging.

LANSING, A. I. *Physiol. Revs., 31,* 274-84 (1951).

Aging is defined as a process of unfavorable progressive change, usually correlated with the passage of time, becoming apparent after maturity, and terminating in death of the individual. To a limited extent it seems true that (1) aging appears after growth stops, (2) an ovum from an old individual has potentialities different from those of a young individual, (3) the capacity for cell growth decreases with age, (4) cytoplasmic pigments frequently increase with age and may be related to mitochondrial changes and (5) data on endocrine changes and cellular chem. changes are at present too scanty to warrant summarization.

MICROBIOLOGY

Variations in the characteristics of E. coli induced by quaternary ammonium compounds.

CROCKER, C. K. *J. Milk Food Technol., 14,* 138-41 (1951).

The development of resistance to quaternary ammonium compds. by *Serratia marcescens* and *E. coli* has been confirmed. Also, these variations in *E. coli* are such as to reduce the value of the various tests used to identify its presence.

NUTRITION

Nutrition for older people.

MCHENRY, E. W. *Canadian J. Public Health., 42,* 142 (1951). *J. Am. Med. Assoc., 147,* 90 (1951).

Older persons often do not eat enough meat, cheese, and milk. Their needs for calcium and iron should have particular attention. Older persons require most vitamins as much as young people. Long-standing food prejudices and faulty food habits are important causes of poor nutrition in older people. List of food essentials for older persons is given.

Utilization of nitrogen, phosphorus, calcium, and iron by men on different breakfasts.

DAUM, KATE, TUTTLE, W. W., KISGEN, ROSEMARY, IMIG, C. J., MARTIN, CONSTANCE, KLAPKA, MARY RUTH, SHEEAN, JOAN, AND OGLE, MARY. *J. Am. Diet. Assoc., 27,* 475-9 (1951).

Ten college men ate an adequate diet for 2 10-week periods in which they ate cereal breakfasts during one period and bacon and egg breakfasts during the other. The periods were reversed so that each subject served as his own control. There were no significant differences in the retentions of nitrogen, phosphorus, calcium, and iron between the periods when the men ate a cereal breakfast and when they ate a bacon and egg breakfast.

Effect of the time factor and calorie level on nitrogen utilization of young women.

LEVERTON, R. M., GRAM, M. R., AND CHALOUPKA, M. *J. Nutrition, 44,* 537-45 (1951).

The implications are that the lower the intake of protein and calories, the greater is the need for including high quality protein in each meal if nitrogen is to be well utilized.

Some effects of caloric intake on nitrogen balance in dogs.

ROSENTHAL, H. L., AND ALLISON, J. B. *J. Nutrition, 44,* 423-30 (1951).

Dogs were fed a const. casein nitrogen intake of 3.82 g. per day per m.² of probable body surface. Calories were varied by altering dietary carbohydrate. The responses to a restricted caloric intake were recognized. The first response, obtained with even a slight reduction in dietary calories, was an increase in the

(Continued on page 26)

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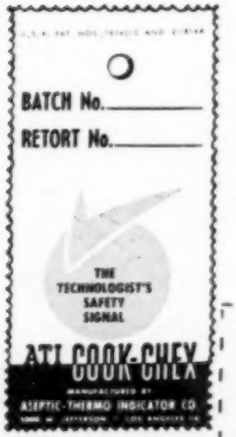

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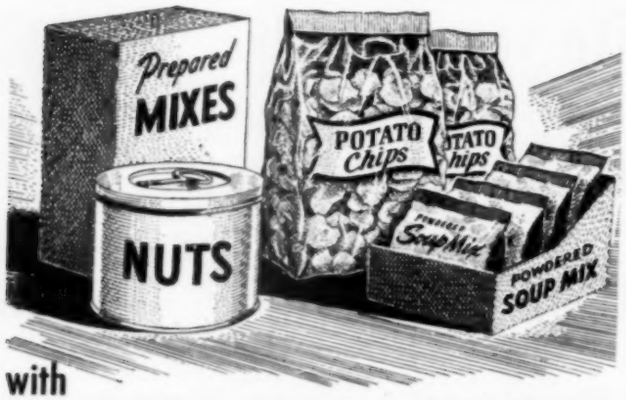

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DIAMOND CRYSTAL
Antioxidant SALT

Abstracts

(Continued from page 24)

the excretion of urinary nitrogen without any change in the nitrogen balance index of the dietary protein, a response which reflected an increase in the catabolism of proteins. Continued feeding of a markedly restricted intake depleted the protein stores of the body. The second response was a decrease in the nitrogen balance index assocd. with a marked increase in the excretion of both body and dietary nitrogen. This second response followed the first in the presence of a severe caloric restriction and was dangerous to the animal.

Vitamin B_{12}, and APF concentrate, aureomycin, streptomycin, liver "L," and fish meal and fish solubles in the nutrition of the poult.

ATKINSON, R. L., AND COUCH, J. R. *J. Nutrition, 44,* 249-63 (1951).

The injection of crystalline B_{12} into poults fed an all-vegetable protein (soybean oil meal-corn) diet failed to have any effect on growth, although such an injection did promote the growth of poults fed aureomycin. Poult growth was stimulated by the feeding of aureomycin, streptomycin, an APF concentrate contg. aureomycin, liver "L", and fish meal and fish solubles. It is believed that the increase in growth assocd. with the feeding of aureomycin and streptomycin was through an effect of the antibiotic on the microflora of the gastrointestinal tract. The APF concentrate, liver "L", and fish meal, and fish solubles were postulated to contain unidentified factors required for poult growth. Supplementation of the basal diet with 8 crystalline B vitamins promoted the growth of poults in some instances but failed to have an appreciable effect in the presence of streptomycin and B_{12} or when the aureomycin APF was fed.

Antibiotics produce faster growth and more efficient food utilization in poultry.

DRAPER, C. I. *Farm and Home Sci., 12,* 44 (1951).

Chicks and turkey poults fed antibiotics grew 6-10% faster, than those fed diets not contg. antibiotics. They also required less feed. Antibiotics added to diets without fish meal gave a greater growth response than when added to rations contg. fish meal. However, the diets contg. fish meal plus antibiotics were superior to those contg. fish meal only.

Evaluation of caries-producing potentialities of various foods.

BIBBY, B. G., GOLDBERG, H. J. V., AND CHEN, E. *J. Am. Dental Assoc., 42,* 491-509 (1951); *Chem. Abstracts, 45,* 6761e-h (1951).

The decalcification potential of a food is the product of (a) the amt. of acid formed from that food by oral bacteria, multiplied by (b) the amt. of that food adhering to the teeth after eating. The decalcification potential of 96 common, carbohydrate-contg. foods, as detd. on human subjects, is reported. Foods with a high fat content tend to be retained in the mouth less than those with a low fat content, those contg. animal fats less than those contg. vegetable fats, those contg. NaCl less than those unsalted, cold foods less than hot foods; texture of the food and the acid-forming power of the subject's saliva are addnl. factors in the decalcification potential.

ENGINEERING

Chemical engineering in the meat-packing industry.

SANDERS, M. D., DEVOUT, A. W., BRADFORD, P., AND BOLLENS, W. F. *Chem. Eng. Progress., 47,* 443-8 (1951).

Description of unit operations and processes in by-product production at Swift and Co., including rendering gelatin and soap manuf., is given.

Performance of industrial aerosol filters.

SILVERMAN, L. *Chem. Eng. Progress., 47,* 462-8 (1951).

A general discussion of filtration of dust from the air.

How baker's yeast is made.

Food Eng., 23, 122-5, May, 1951.

Multi-stage operation flowsheet is given.

(Continued on page 28)

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Abstracts

(Continued from page 26)

Permanent pipe lines for dairy plants.

MOORE, D. R., TRACY, P. H., AND ORDAL, Z. J. *J. Dairy Sci., 34,* 804-14 (1951).

Under conditions of this study, a permanently installed pipe line of either stainless steel or glass was found to be satisfactory from a sanitary point of view.

FOOD PRODUCTS

CANNED AND FROZEN FOOD

How to check precipitation in canned citrus juice.

KASSAB, M. A. *Canner, 112,* 13, June 30, 1951.

The expts. described were carried out on summer oranges in an attempt to discover the best method for preventing pptn. of the juice. Centrifuging and use of pectin and gums were the two important methods used.

The effect of canning procedures on the nutritive value of the protein in peas.

ARMBRUSTER, G., AND MURRAY, H. C. *J. Nutrition, 44,* 205-16 (1951).

1. Three samples of Alaska field peas studied showed that canning procedures did not affect the protein efficiency. Rats on diets contg. canned peas gained less wt. than animals on the corresponding raw pea diets. 2. When the peas were canned at a pH of 4.5, there was a significant decrease in the protein efficiency; when the canning was done at a pH of 8.5, the protein efficiency did not change but the wt. gain was significantly decreased. 3. Supplementing raw peas with methionine substantially raised the protein efficiency. When lysine was used as a supplement for raw peas, a significant increase in protein efficiency resulted; but when it was used as a supplement for canned peas a significant decrease became apparent. 4. A digestibility study showed that raw peas are somewhat more digestible than canned. 5. The reducing sugar, alpha amino nitrogen, and methionine contents of the peas were decreased by canning procedures.

Do shifting temperatures hurt stored frozen foods?

Food Packer, 32, 38, May, 1951.

The importance of const. storage temps. in preserving the initial quality of frozen foods is discussed.

FATS AND OILS

Monostearates in the food industry.

Food Manuf., 26, 332 (1951).

Glyceryl monostearate and propylene glycol monosterate are seen to have many uses as emulsifiers in improving shortening fats and oils, making certain water insol. materials compatible to aq. media and enhancing appearance and freshness of cakes having a high sugar content. These glycerides also combat frothing in fermentation processes and better compressed yeast manufacture by preventing lumping.

GELATIN AND PECTIN

The chemical composition and properties of pectins.

JONES, J. K. N. *Chem. and Ind.,* 430-1 (1951).

The important component of pectin is methyl pectate, a polysaccharide derivative of high mol. wt., built up of D-galacturonic acid residues. While methyl pectate is sol. in cold water, pectic acid is insol. in water, but dissolves in soda or ammonia; both form solns. of high viscosity and are degraded by acids, alkalis, and enzymes. Their suitability for jelly formation depends largely on the mol. size (av. chain length) of the pectic acid mol. and upon the amt. of ballast materials (galactan, araban, etc.) present. Pectic acid closely resembles alginic acid in chem. and phys. properties.

Color-formation in gelatin manufacture.

BLAKE, J. N., AND PLASTER, F. H. *J. Soc. Leather Trades Chemists, 34,* 177-86 (1950). *Brit. Abstracts, BII,* 168 (1951).

A standard procedure for detg. the effect of sugar on color formation in gelatin consists of heating gelatin soln. (5 g. in 50 ml. of H_2O) at 134° F. with 5 ml. of sugar soln. (2½%) for ½ hr. The soln. is diluted and filtered and the color detd. by means of a colorimeter using a tricolor blue filter. Using glucose, the color depends on the amt. of SO_2 present in the gelatin. SO_2 is the most effective inhibitor of color formation known. The color formation depends on the sugar and is least for sucrose and greatest for galactose. Sucrose gives more color in acid soln. and the color gradually diminishes to zero at pH 6. Other sugars give little color in acid soln. but the color increases rapidly at pH 5.5. The effect of cystine and cysteine on color formation with sugar is small. All gelatins examd. contained traces of furfuraldehyde which gives an intense brown color when autoclaved with cystine but gives a lighter color with other amino-acids. If sugar is removed from gelatin prior to heating; by means of yeast, the resulting gelatin has an improved color. Using the orcinol method, gelatin was found to contain 0.40-0.68% of sugar as lactose. The sugar content of air-dry collagen fell from 0.95% in the original material to 0.68% after two weeks liming. The sugar present in raw collagen may influence the formation of color in gelatin manufacture.

MILK PRODUCTS

The effect of heat treatment on the nutritive value of milk proteins.

Cook, B. B., Frankel-Conrat, J., Singer, B., Morgan, A. F., Buell, R., and Moises, J. G. *J. Nutrition, 44,* 217-35 (1951).

The effects of heat or lactose or both on casein and several types of lactalbumins have been investigated. These milk proteins have been shown to bind lactose in amts. ranging from 2 to 8% under different exptl. conditions. Casein, refluxed at 95° C. for 24 hours in a soln. contg. a ratio of protein to lactose of 1:1, bound twice as much lactose as when heated at 52° C. for the same length of time in a soln. in which the ratio of protein to lactose was 1:0.3 or 3.5:5. That free amino groups are essential for reaction with lactose was established by acetylation expts. Acetylated lactalbumin reacted with no lactose present. Acetylated casein reacted with considerably less lactose than did the original protein. Heat alone had no appreciable effect on the total *in vitro* digestibility or availability of amino acids of A (sol.) lactalbumin but led to a decreased digestibility of casein and ethanol-precipitated lactalbumin. Heat subsequent to reaction of the proteins with lactose greatly intensified the decrease in nutritive value of both casein and lactalbumin.

SUGARS AND STARCHES

The enzymic synthesis and degradation of starch. Part XII. The mechanism of synthesis of amylopectin.

Hobson, P. N., Whelan, W. J., and Peat, S. *J. Chem. Soc.*, 596-8 (1951).

Evidence is presented which necessitates a modification of the hypothesis proposed earlier (J., 1945,877) whereby the synthesis of amylopectin from glucose-1 phosphate was pictured as involving the intermediate formation of short unbranched chains of glucose units (pseudoamylose). It is now shown that the synthesis proceeds as follows:

$$\text{Glucose-1 phosphate} \xleftarrow{\text{Phosphorylase}} \text{Amylose} \xrightarrow{\text{Q-enzyme}} \text{Amylopectin}$$

VEGETABLES

Blanching of vegetables.

Virmani, R. S., and Tandon, G. L. *Indian J. Hort., 7,* 1-9 (1950); *Biol. Abstracts, 25,* 2094, No. 23170 (1951).

Blanching of potatoes in 0.1% $NaHCO_3$ soln. before drying gave better results than other methods tried in improving the appearance and taste of the product by reducing regeneration of catalase activity.

INDUSTRIAL CHEMISTRY

Report of standards committee, ASQC.

Ind. Qual. Control, 8, 14-17, July, 1951.

Standard definitions and symbols for control charts as submitted by the Standards Committee, American Society of Quality Control are given.

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Abstracts

ORGANIC CHEMISTRY

Mechanism of autoxidation of fats. I. Kinetics of catalytic oxidation of oleic and linoleic acids.

MUKHERJEE, S. *J. Indian Chem. Soc., 27,* 230-7 (1950). *Brit. Abstracts, BII,* 101 (1951).

The autoxidation of oleic (I value 89.9) and linoleic (I value 181.1) acids is studied in the primary stage by shaking with O_2 in a Warburg app. with a trace of haematin as catalyst. O_2 consumption, and peroxide and I value are detd. periodically. It is concluded that in the initial stages of oxidation of oleic acid the O_2 is entirely absorbed by formation of a cyclic peroxide at the double bond. In the oxidation of linoleic acid only one double bond is thus satd. In the later stages of oxidation it is possible that attack takes place at the active methylene group, together with satn. of the second double bond in the case of linoleic acid.

PHYSICAL RESEARCH

Surface area of porous adsorbents.

FU, Y., AND BARTELL, F. E. *J. Phys. and Colloid Chem., 55,* 662-75 (1951).

A method for the detn. of the sp. area of porous solids using only adsorption data and not involving the dimensions of the adsorbates has been presented and applied to porous glass, cellulose, ferric oxide, and silica gels. The results obtained by this method agree satisfactorily with those by the B.E.T. method.

PATENTS (U. S. A.)

Bread staling.

MILLER, JR., F. W., AND KRALOVEC, R. D. Assignors to E. I. duPont de Nemours and Company. 2,564,124, August 14, 1951.

A method of decreasing staling in bread which comprises incorporating in the dough, prior to baking, from 0.5 to 2% based on the wt. of flour of non-aethyleneglycol monostearate.

Baked goods with cheese flavor.

KASS, P. Assignor to International Chemical Corp. 2,564,763, Aug. 21, 1951.

The process of making baked goods characterized by a pronounced cheese flavor which includes incorporating leucine and a mild cheese, in itself incapable of flavoring the baked goods, with the ingredients of a leavened dough and fermenting the dough.

Process of preparing a coffee concentrate.

NUTTING, L. Assignor to Hills Bros. Coffee, Inc. 2,562,206, July 31, 1951.

A process of prepg. a dry coffee concentrate with restored volatile flavor constituents including the steps of introducing steam into the ground roasted coffee to wet and to liberate the volatile constituents thereof, condensing the steam and volatiles mixt. to form an ext. of the volatile constituents of the coffee, subsequently treating the ground roasted coffee with water to form an aq. extn. to reduce the water content thereof, then mixing the concd. aq. ext. with the ext. of the volatile constituents and then drying the mixt.

Dual extraction of grease, glue, and gelatin.

TOUR, R. S. Assignor to Darling and Company. 2,562,221, July 31, 1951.

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The method of deriving glue and grease from animal substances which previously have been limed, which method comprises, washing the animal substances in water which resides in layer relationship to substantially water immiscible grease-receptive solvent, and thereby removing lime from the animal substances and partially liberating grease therefrom removing the wash water, neutralizing the hide stock while it is in contact with the solvent, subsequently cooking the animal substances in water at temps. sufficient to convert collagen present in the animal substances into gelatin, while repeatedly and successively exposing the animal substances during cooking to the water and to the grease-receptive solvent thereby completing liberation of grease from the animal substances and simultaneously converting collagen to gelatin, and finally sepg. the grease-laden solvent from the gelatin-laden water.

Dehydration of potatoes.

Bostock, B. R. Assignor, by mesne assignments, to Thomas J. Lipton, Inc. 2,564,296. August 14, 1951.

A process of drying potatoes which comprises cooking the potatoes, mashing the cooked potatoes, freezing the mashed potatoes, thawing the frozen mass at a temp. slightly above 0° C. and below 10° C. mechanically sepg. water from the thawed mass and thereafter drying addnl. water from the partly dewatered mass.

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NEW TEXAS ALUMINUM PLANT TO USE LIGNITE AS ENERGY SOURCE

Acting Secretary of the Interior Richard D. Searles has announced that he has recommended to the Defense Production Administration that certificates of necessity be issued to the Aluminum Company of America for construction in Milam County, Texas, of new aluminum production facilities having a capacity of 85,000 short tons per year, together with facilities for the production of 180,000 tons of alumina per year.

Secretary Searles said that the power required for the new facilities will be generated by Alcoa using lignite from deposits near Sandow, Texas, as the source of fuel.

Alcoa's bauxite mining facilities would be expanded, either at Suriname, South America, or at Bauxite, Arkansas.

"Use of Texas lignite for the generation of power," Acting Secretary Searles stated, "brings into use a new important energy resource in the manufacture of aluminum. The company has an interim power contract with Texas Gas and Light Company which will take care of power needs until the firm's own steam and turbine generating plant using lignite as fuel is constructed. Texas has great proven reserves of lignite and the company proposes to conduct extensive research in the use of the tar residue which will come from the lignite fuel."

Of the 638,000 tons of additional aluminum production capacity, certified as necessary for national defense under dates of December 11, 1950, and May 18, 1951, 514,000 tons had previously been allocated or recommended for allocation.

Altogether, expanded aluminum capacity totalling 599,999 tons has now been allocated or recommended for allocation.

For details see: Interior release 2493. [From *Defense Production Record*, 1, (16) 3 (1951), August 16.]

ABSTRACTS OF LITERATURE ON COFFEE COMPILED

The Technical Collaboration Branch of the USDA office of Foreign Agricultural Relations has published a 133-page booklet entitled "Abstracts of some of the literature pertaining to coffee" by Julian C. Crane and Laurenz Greene (1948). These abstracts, prepared for the use of research workers interested in coffee, give sufficiently detailed summaries with tables and illustrations to enable those research workers to whom the various journals and other publications are not easily available to perform a preliminary search far more thorough than what the customary abstracts journals would permit. The bulk of these publications appeared in foreign and often obscure journals or bulletins. The abstracts are classified into sections on Soils and Nutrition, Varieties and Breeding, Propagation, Pruning, Flowers and Fruiting, and General Information, the latter including information on coffee diseases, coffee technology, and a variety of other topics. (ZIK)

Advertisers' Index

	PAGE
American Can Co.	1
Anheuser-Busch, Inc.	6
Aseptic-Thermo Indicator Co.	24
Brewers Yeast Council, Inc.	33
Continental Can Co.	12-13
Corning Glass Works	7
Distillation Products Industries	5
Dodge & Olcott, Inc.	4
Dow Corning Corp.	29
Firmenich, Inc.	3rd cover
Florasynth Laboratories, Inc.	28
Food Development Laboratory	34
Food Machinery & Chemical Corp.	11
Food Research Laboratories, Inc.	34
Fritzsche Bros., Inc.	34
General Foods Corp. (Diamond Crystal Salt)	26
Griffith Laboratories, Inc.	4th cover
Hoffman-LaRoche, Inc. (Vitamin Div.)	18
Huron Milling Co.	30
LaWall & Harrisson	30
Magnus, Mabee & Reynard, Inc.	23
Merck & Company, Inc.	2
Minneapolis-Honeywell Regulator Co. (Industrial Division)	20-21
Norda Essential Oil & Chemicals Co., Inc.	31
Orkin Institute	25
The Pfaudler Co.	2nd cover
Chas. Pfizer & Co., Inc.	17
Schwarz Laboratories, Inc.	31
Seaplant Chemical Corp.	16
Foster D. Snell, Inc.	34
Sterwin Chemicals, Inc.	15
Wm. J. Stange Co.	9
U. S. Stoneware Co.	19
van Ameringen-Haebler, Inc.	27
Vegetable Juices, Inc.	32
Wahl-Henius Institute	33
Wallace & Tiernan Co., Inc.	33

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CONTENTS

SWEETENING AGENTS FOR CANNED PEACHES. Gladys L. Gilpin, Katherine R. Ebner, and Eleanor L. Geissenhainer . . . 81

BEHAVIOR OF THE ANTHOCYANIN PIGMENTS IN CONCORD GRAPES DURING HEAT PROCESSING AND STORAGE. L. V. L. Sastry and R. G. Tischer . . . 82

MECHANICAL REFRIGERATION IN THE TRANSPORTATION OF PERISHABLE FOOD. W. H. Redit . . . 86

SOME PRACTICAL PROBLEMS IN THE INTRODUCTION OF NEW FOOD PRODUCTS. Franklin C. Bing . . . 91

FOOD PREFERENCES OF PRE-ARMY AGE CALIFORNIA BOYS. Barbara M. Kennedy . . . 93

LABORATORY AND FIELD TEST EVALUATION OF THE METHYL ESTER OF ALPHA NAPHTHALENE ACETIC ACID AS A SPROUT INHIBITOR FOR POTATOES. J. R. Wagner, M. Simon, and Frances I. Hemphill . . . 98

CLARIFICATION OF WINE BY A SEQUESTERING AGENT. Jack K. Krum and Carl R. Fellers . . . 103

GROWTH OF FOOD YEASTS IN OLIVE RESIDUE HYDROLYSATE. Elda Tsilenis and L. R. Hedrick . . . 107

FACTORS AFFECTING THE STABILITY OF COLOR OF CANNED RIPE OLIVES. W. V. Cruess . . . 110

CANNING "LITTLE TUNA" (EUTHYNNUS ALLETERATUS). N. D. Jarvis . . . 113

NOTES AND LETTERS: THE USE OF LYCOPENE DETERMINATIONS FOR DETECTING ADDED WATER IN CANNED TOMATOES. Amihud Kramer . . . 117

BOOK REVIEW . . . 118

REGIONAL SECTION NEWS . . . *6*

SELECTED ABSTRACTS . . . *12*

Authors of papers intended for publication in FOOD TECHNOLOGY should request from the editorial office a copy of the booklet, entitled "Information and suggestions to authors." Manuscripts submitted for publication in FOOD TECHNOLOGY should follow the style described in this booklet.

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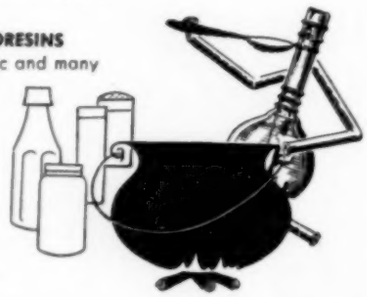

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NEW PRODUCTS DISPLAY AT THE 1952 ANNUAL MEETING

A novel feature of the IFT Annual Meeting at Grand Rapids, Michigan, will be a special new products display. This display will be open for inspection all day Tuesday, June 10, 1952, in conjunction with an outstanding Symposium on "Research planning" and "New food products."

Consumer food products, or new or improved foods for institutional use, that have not been in general distribution prior to January 1, 1951 will be eligible for display. The development or improvement may be in the food item itself or in its packaging.

Inspection of packages will be permitted throughout the day. Following the presentation of the last paper of the Symposium, the packages may be cut for further examination.

To reserve space, or for further information about this opportunity for all IFT members to participate in the annual meeting, write to Dr. Franklin C. Bing, 30 West Washington Street, Chicago 2, Illinois, who is in charge of arrangements of this feature of the Grand Rapids meeting.

FUTURE DATES FOR FOOD TECHNOLOGISTS

March 3-7	National Association of Frozen Food Packers, Hotel Stevens, Chicago, Ill.
Mar. 31-Apr. 3	Division of Agricultural and Food Chemistry, American Chemical Society, Spring Meeting, Milwaukee, Wis.
April 1-4	National Packaging Exposition, Atlantic City Auditorium, Atlantic City, N. J.
April 15-17	Research and Development Associates, Food and Container Institute, Inc., Palmer House, Chicago, Ill.
April 20-25	American Association of Cereal Chemists, National Convention, Adolphus Hotel, Dallas, Texas.
April 28-30	American Oil Chemists' Society, Spring Meeting, Shamrock Hotel, Houston, Texas.
May 11-15	Super Market Institute, Annual Super Market Convention, Cleveland Public Auditorium, Cleveland, Ohio.
May 25-28	Flavoring Extract Manufacturers' Association, Annual Convention, Edgewater Beach Hotel, Chicago, Ill.
June 1-5	National Confectioners' Association, Annual Convention and Exposition, Hotel Conrad Hilton, Chicago, Ill.
June 8-12	**Institute of Food Technologists, Twelfth Annual Meeting, Grand Rapids, Mich.**
June 19-22	American Plant Food Council, Annual Meeting, The Homestead, Hot Springs, Va.
June 24-26	American Dairy Science Association, Annual Meeting, Davis, Calif.
August 4-8	Food and Nutrition sessions, Gordon Research Conferences, AAAS, New London, N. H.
Sept. 29-Oct. 1	Association of Official Agricultural Chemists, Annual Meeting, Shoreham Hotel, Washington, D. C.

(Information concerning future dates of national and international meetings, conventions and exhibits of interest to food technologists should be sent to the editorial office.)

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Regional Section News

FLORIDA SECTION

The Florida Section of the Institute of Food Technologists and the Florida Section of the American Chemical Society held a joint meeting on Friday, January 18th, at the Angebilt Hotel, Orlando. The speaker for the occasion was Dr. R. A. Dutcher, former head of the Department of Agricultural and Biological Chemistry at the Pennsylvania State College, who spoke on the subject "Milestones in Vitamin Research."

OREGON SECTION

On October 26th, the Oregon Section met at the Blitz Weinhard Company, Portland, Oregon. The company provided guided tours of the plant. The tours were followed by a talk given by Mr. Bill Hamilton, Assistant Brewmaster. Mr. Hamilton spoke about the brewing industry in general and problems concerning it.

On January 4th, the Section met at the Amalgamated Sugar Company, Portland, Oregon. Following a tour of the new plant, Mr. Frank Rawlings, Director of Research, spoke on "What's New in Sugar Processing and Handling."

Robert F. Cain, recent chairman of the Texas Section, was introduced and told the group about the Texas regional section.

NORTHEAST SECTION

The Section held its February meeting on the 7th at the Hotel Brunswick, Boston, Mass., at which time the group heard Mr. John P. Bolanowski, Manager of Research, Votator Division, The Girdler Corporation, Louisville, Ky., who spoke on the subject "Rapid Heat Transfer and its Utilization in Modern Food Industries." This meeting was in charge of the Samuel Cate Prescott Student Chapter of the Institute of Food Technologists at Massachusetts Institute of Technology.

GREAT LAKES SECTION

The Hart Hotel at Battle Creek, Mich., was the scene of the Section's January meeting, held Friday, January 25th. An afternoon session was devoted to a symposium on packaging, at which time the following papers were heard:

"Paper board and its use in food packaging" by Dr. James J. Harrison, Technical Director, Michigan Carton Co., Battle Creek, Mich.

"Sealing glass containers for the food industry" by H. Clifford Scott, Packaging Consultant, Packaging Research Division, Owens-Illinois Glass Co., Toledo, Ohio.

"Country store to super-market—and some packaging problems" by Dr. G. F. Des Autels, Research Department, Kalamazoo Vegetable Parchment Co., Kalamazoo, Mich.

Following dinner at the Hart Hotel, Mr. R. P. Campbell, Product Manager, Post Cereals Division, General Foods Corp., Battle Creek, Mich., addressed the group on the subject "The Importance of Good Packaging in the Marketing and Merchandising of Food Products."

SOUTHERN CALIFORNIA SECTION

The Section met on January 16th at the Roger Young Auditorium, Los Angeles, and speaker for the occasion was Dr. Louis B. Rockland of the U. S. D. A. Fruit and Vegetable Chemical Laboratory, who presented an extremely interesting paper on "Recent Developments in Chromatography." Dr. Rockland augmented his talk with slides and a visual demonstration with the assistance of Dr. Underwood, also of the U. S. D. A. Fruit and Vegetable Chemical Laboratory. A lively discussion followed the paper, which showed evidence of the intense interest in the subject.

PHILADELPHIA SECTION

On January 17th, the Section met at the Whittier Hotel, Philadelphia, when Dr. Firman E. Bear, Chairman, Soils Department, Rutgers University, New Brunswick, N. J., addressed the group on the topic "The Inorganic Side of Life." The group felt fortunate in having Dr. Bear address its January dinner meeting inasmuch as he is the Editor-in-Chief of *Soil Science*, a technical magazine devoted to soil research, and also because he is the author of two widely known textbooks "Theory and Practice in the Use of Fertilizers" and "Soils and Fertilizers." Dr. Bear is also the past president of the American Society of Agronomy, the Soil Science Society of America and Soil Conservation Society of America. At Rutgers, Dr. Bear has launched a number of new investigations, among which are some highly significant studies into the role of trace elements in plants and soils.

Here is an interesting note that has come out of the Section's November meeting when Dr. George Garnatz, Director of the Kroger Food Foundation, Cincinnati, Ohio, gave a talk on "Experience with a Large Consumer Panel for Gauging Product Acceptability." Only 29 members of the audience were able to identify correctly the two identical samples of tomato juice submitted to them during the meal. Three samples of tomato juice were given each member to taste, two were identical and one different. In an ice-cream test only 14 out of the group were able to identify the paired samples. These tests demonstrated problems that are confronted by operators of panel testing "as well as the fact that the IFT members need a little brushing up on their taste." Dr. Garnatz demonstrated how the Kroger Foundation operated its testing panel, and how it correlated the results and applied them to commercial operations.

PUGET SOUND SECTION

The Puget Sound Section of IFT held its December meeting jointly with the American Chemical Society at a dinner in the Evergreen Room of the Student Memorial Building on the campus of the University of Washington. The first regular meeting of the Puget Sound Section of the chemical society was held March 27th, 1909, and this meeting was a memorial occasion celebrating the 300th regular meeting. Dr. H. K. Benson, formerly professor of Chemical Engineering at the University of Washington, one of the leaders in the

(Continued on page 8)

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Regional Section News

(Continued from page 6)

early organization of this northwestern section, recalled that the majority of the charter members were food technologists. Dr. T. L. Swenson, chairman of the IFT Section, commenting later in the program on the progress of food technology, dramatically showed the close liaison between the two groups to still be in existence by requesting a raise of hands of all those affiliated with both groups.

The speaker on the program was the newly appointed Chief Chemist, Northwest Division, of the Food and Drug Administration, Mr. N. D. Voth, formerly of the Northeast Division at Boston. His topic "Work of the Food and Drug Chemist" augmented by a descriptive film, was most instructive and prompted a splendid discussion before the meeting was adjourned. Guests in attendance were from the Oregon Section of IFT, the Western Regional Research Laboratory and western industries.

IFT Speaker Wanted

Your News Editor has received a letter from T. C. Webber, Secretary of the Puget Sound Section, in which he states that the Puget Sound Section is desirous of having a speaker contact them who may be travelling in the neighborhood on or about the middle of March. Mr. Webber would be most pleased to correspond with those who are interested in accepting this invitation.

PERSONNEL

ROBERT F. CAIN has joined the staff of the Food Technology Department, Oregon State College, Corvallis, Oregon. Mr. Cain has been with the Texas A. & M. College, and was chairman of the Texas Regional Section of IFT.

WILLIAM FILZ, Assistant Food Technologist, Oregon State College, Corvallis, Oregon, is now plant manager of a new cranberry processing company whose plant is located on the Guy C. Myers Cranguyma Farms at Long Beach, Washington.

KEITH A. FITCH, formerly with the California Bureau of the Food and Drug Administration, and Standard Brands, Inc., is Executive Director of the newly formed Orkin Institute of Industrial Sanitation with headquarters at Atlanta, Georgia. He served as a Lt. Colonel during the last war. The new firm will specialize in professional consultative, inspectional and educational services to industry.

CURTIS E. MAIER, General Manager, Research Division of Continental Can Company, has received the Certificate of Appreciation Award by the Department of the Army for his service during World War II with the Technical Industrial Intelligence Committee, Joint Chiefs of Staff. During his work with the Committee, Mr. Maier was assigned to make a complete investigation of the methods and materials employed by the German can manufacturing companies during the war.

WALTER L. OBOLD, Head Biological Sciences, Drexel Institute of Technology, Philadelphia, Pa., left on December 7th for a six-months tour of duty as exchange professor to Egypt. Dr. Obold is chairman of the Philadelphia IFT Section, and in his absence Mr. Robert C. Bucher, Chemist with the Frank H. Fleer Corporation, Philadelphia, is acting chairman.

OBITUARY

J. E. "MIKE" SIMMONS, 60, Head of the Bacteriology Department at Oregon State College, Corvallis, Oregon, and a member of the college staff for 32 years, died suddenly from a heart attack December 30th.

Professor Simmons received both his Bachelor's and Master's degrees from the University of Wisconsin. He was with the Rockefeller Institute for Infectious Diseases at New York and the Army Medical School at Yale University. During World War I, he served as a lieutenant in the sanitary corps. He was well known and active in the Oregon Section of the Institute of Food Technologists.

LIST OF EXHIBITORS AT THE 1952 ANNUAL MEETING AT GRAND RAPIDS

The following concerns have already made arrangements for exhibits at the 1952 Annual Meeting of the IFT to be held at Grand Rapids, Michigan, June 8-12:

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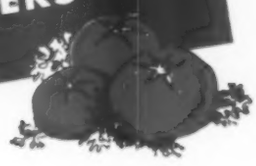

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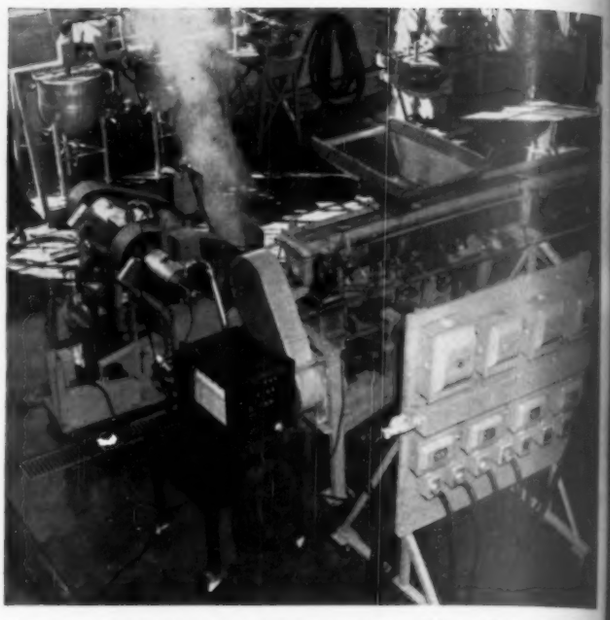

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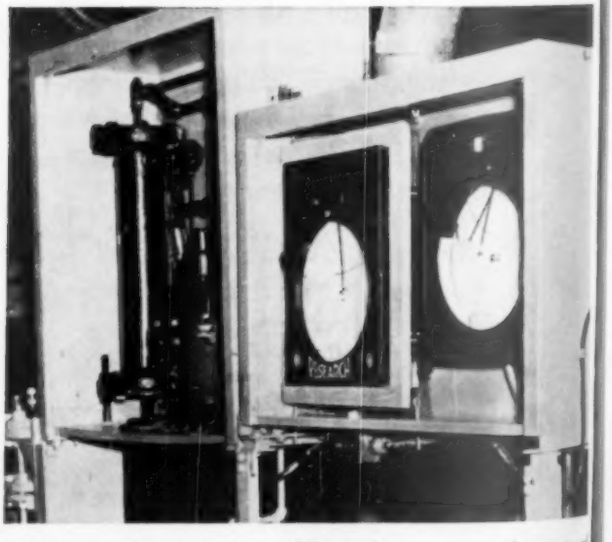

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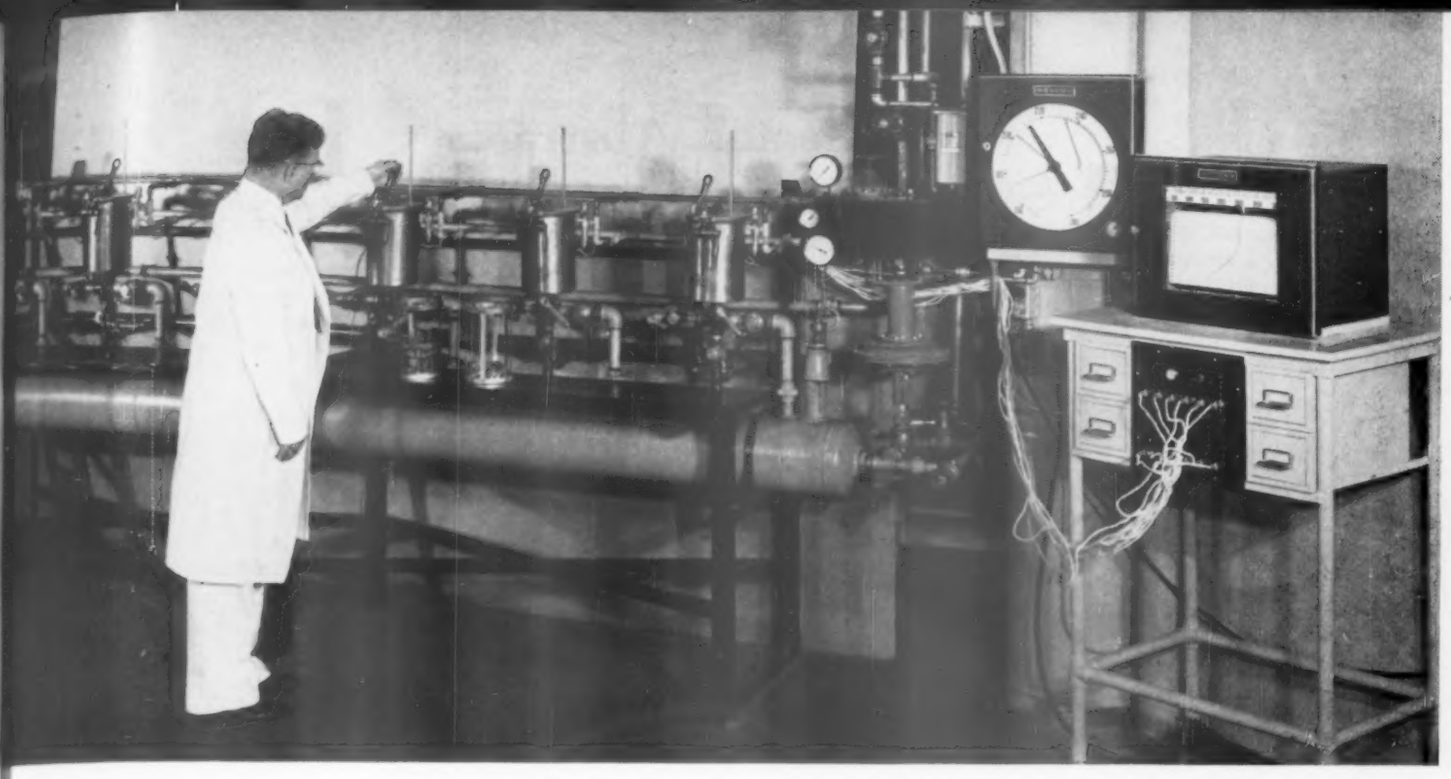

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Selected Abstracts[a]

ANALYTICAL METHODS

Application of paper chromatography in the analysis of foods. Identification and separation of vanillin, ethylvanillin, piperonal, and coumarin.

BERGNER, K. G., AND SPERLICH, H. *Deut. Lebensm. Rundschau, 6,* 134-8 (1951); *Chem. Abstracts, 45,* 8156c (1951).

The principle of paper chromatography is discussed at length. The extn. of foods can be done with alc., acetone, and ether. The best solvent for vanillin (I), ethylvanillin (II), piperonal (III), and coumarin (IV) was found to be petroleum ether. The H_2O content of the paper (S and S. 597 and 604) should be 10-15%. A table is given which gives detailed directions for the treatment of the paper and the color (fluorescence) reactions of I, II, III, and IV each in the following 3 combinations: I and II; I, II, and III; and I, II, and IV. For the quant. analysis, alc. solns. of known quantities of I, II, III, and IV are made up. Directions are given in detail for the chromatographic detns. of I, II, III, and IV as well as construction of a modified app. used in the analysis. (18 references).

The chromatographic examination of sugars in wheat flour.

WILLIAMS, K. T., AND BEVENUE, A. *Cereal Chem., 28,* 416-23 (1951).

Wheat flour carbohydrates sol. in 80% ethyl alc. were examd. by paper chromatographic technics. Four commercially-milled flours of different types gave chromatograms that indicated that the same sugars were present in each of the flours. Fructose, glucose, sucrose, maltose, raffinose, and arabinose were identified. In addn. a slow-moving spot, assumed to be Tanret's levosine, was resolved by extended periods of irrigation into at least seven substances, each possessing a ketose structure and contg. fructofuranoside linkage. All, except the material remaining at the starting line of the chromatograms, are fermentable by bakers yeast. These seven fractions represented about 75% of the reducing power of the alc. sol. carbohydrates.

Radioactive tracers in paper partition chromatography of inorganic ions.

FRIERSON, W. J., AND JONES, J. W. *Anal. Chem., 23,* 1447-52 (1951).

Paper partition chromatography has been successfully used in many sepns. of inorg. ions. An effort has been made to develop technics in the use of radio-active elements in order to enlarge the usefulness of this method of analysis. A device for scanning paper chromatograms is described. Radioactive tracers have been found useful for locating and identifying an element. The technics for identification may be based on decay and growth, energy of radiation, and type of radiation. They have been applied to the identification of radiochem. impurities, and they are useful in locating and identifying the elements on a paper chromatogram, especially when there is no satisfactory reagent for identifying small amts. of the ions on paper and the ions are not well sepd. These methods should find important applications in nutrition and plant growth studies.

Variability in the Beckman spectrophotometer.

CASTER, W. O. *Anal. Chem., 23,* 1229-36 (1951).

The largest variations were assocd. with the photo tube or with factors such as slit width, lamp intensity, and aging which directly affects phototube response. When the instrument is used for relative values, to compare a series of unknowns with a set of standards, good and consistent results can be expected, with a variation in the order of 0.5%. In the measurement of absolute values such as extinction coeffs. of $E.^{1\%}_{1cm.}$ a variability of 5% may be expected.

Spectrophotometric determinations of esterases.

HOFSTEE, B. H. J. *Science, 114,* 128-30 (1951).

Salicylic acid strongly absorbs ultraviolet light of a wavelength of 290 mμ-300 mμ, whereas acetylsalicylic acid (aspirin) does not absorb at all in this region. This was found to hold true for other fatty acid esters of salicylic acid as well. This principle provides a convenient and sensitive method for the detns. of esterases in general. Because of the free carboxy group, these compds., including the longer chain fatty acid esters, are sol. in solns. of low acidity and can be used as substrates in continuous spectrophotometric measurements. The hydrolysis of as little as 0.01 micromole of such an ester can be detected.

Colorimetric determination of peanut skin in peanut presscake.

DANGOUMAU, A., DEBRUYNE, H., AND CLUZAN, R. *Bull. Soc. chim. France* 435-6 (1951); *Chem. Abstracts, 45,* 9195c (1951).

Refluxing peanut presscake with 95% EtOH contg. 1.25% HCl for 30 min. produces a red color when peanut skins are present. The intensity of the color is directly proportional to the amt. of skin.

Automatic countercurrent distribution equipment.

CRAIG, L. C., HAUSMANN, W., AHRENS, JR., E. H., AND HARFENIST, ELIZABETH J. *Anal. Chem., 23,* 1236-47 (1951).

The app. is a strictly discontinuous extn. train contg. 220 glass equilibration cells. The train is operated by automatic equipment. In 24 hours 800 equil. stages (roughly 150,000 extns.) are obtainable. As a "recycling" feature permits several thousand equil. stages to be applied, the question of "purity" can be decided with a considerable degree of certainty.

Determination and characterization of pectins with the help of ion exchangers.

ANYAS-WEISZ, L., AND DEUEL, H. *Mitt. Lebensmitt-Untersuch. Hyg., 42,* 91-105 (1951); *Brit. Abstracts, C,* 344 (1951).

Solns. of pectins are purified for titrimetric analysis by continuous percolation (20-25 ml. per min.) through columns of ion exchanges (~30 ml. each in two sep. columns, 16-18 mm. in diam.), the cation exchanger (Amberlite IR-120, H form) being placed above, and connected with the anion exchanger (Amberlite IR-4B, OH-form); the soln. (contg. 0.5% of pectin and 0.6-0.8% of electrolytes of low mol. wt.) is thus freed from electrolytes of low mol. wt. (acetates and acetic acid). Ca is exchanged for Na in the upper column, and the pectins are discharged, unadsorbed, with the free carboyxl groups as such. To det. the total galacturonic acid carboxyl groups (a) in the pectin, the soln. is treated with an excess (~10-fold, or more with very dil. pectin solns.) of aq. 0.1*N*. NaOH for 2 hr. at room temp., and, after percolation through the exchangers, titrated with aq. 0.1*N*.-NaOH. To det. the free carboxyl groups (b), the percolate from the original soln. is titrated with 0.1*N*.-NaOH. The content of methoxyl groups (c) equals a — b (in NaOH equiv.). To det. the acetyl groups (d), the total ester groups (methoxyl and acetyl) (e) are detd. by adding a known excess of aq. 0.1*N*. NaOH to the neutralized pectin soln. to saponify all these groups, and titrating back with aq. 0.1*N*. HCl; the NaOH used up gives *e*; then *d* equals *e* — *c*. The percentages of methanol and acetic acid esterifications are, resp., 100 *c*/*a* and 100 *d*/2*a*. Examples are given of the application of the method to quince preserves, grape and apple juices, sugar-beet exts., and artificially acetylated apple pectins. Non-electrolytic impurities of high mol. wt. do not interfere with titration results. Sugar-beet pectin, which appears to contain complex hemicelluloses in combination, gives lower results by titration than by gravimetric detn. as Ca pectate. Proteins are removed by tannin-pptn. before the analysis.

The oxalic acid content of some common foods.

ANDREWS, J. C., AND VISER, E. T. *Food Research, 16,* 306-12 (1951).

The method of estn. of oxalic acid in various foods has been studied and optimum conditions have been detd. for both the acidity and the time of extn. in both the acid and the ether extns. The oxalic acid content, as estd. by this procedure, is reported for about 45 foods. With only 4 exceptions, results are substantially higher than those of previous investigators. Seven of these among the fresh foods show contents of oxalic acid above 0.1%.

Chemical analysis of tea.

VIEIRA, C. A. *Rev. chim. pura e applicada, 33,* 216-36 (1950); *Brit. Abstracts, C,* 344 (1951).

(Continued on page 17 following technical papers)

[a] These Selected Abstracts are made available to FOOD TECHNOLOGY through the cooperation of Associate Editor H. A. Campbell and the General Foods Corporation of New York, N. Y. The abbreviations found in these abstracts are similar to those used by Chemical Abstracts.

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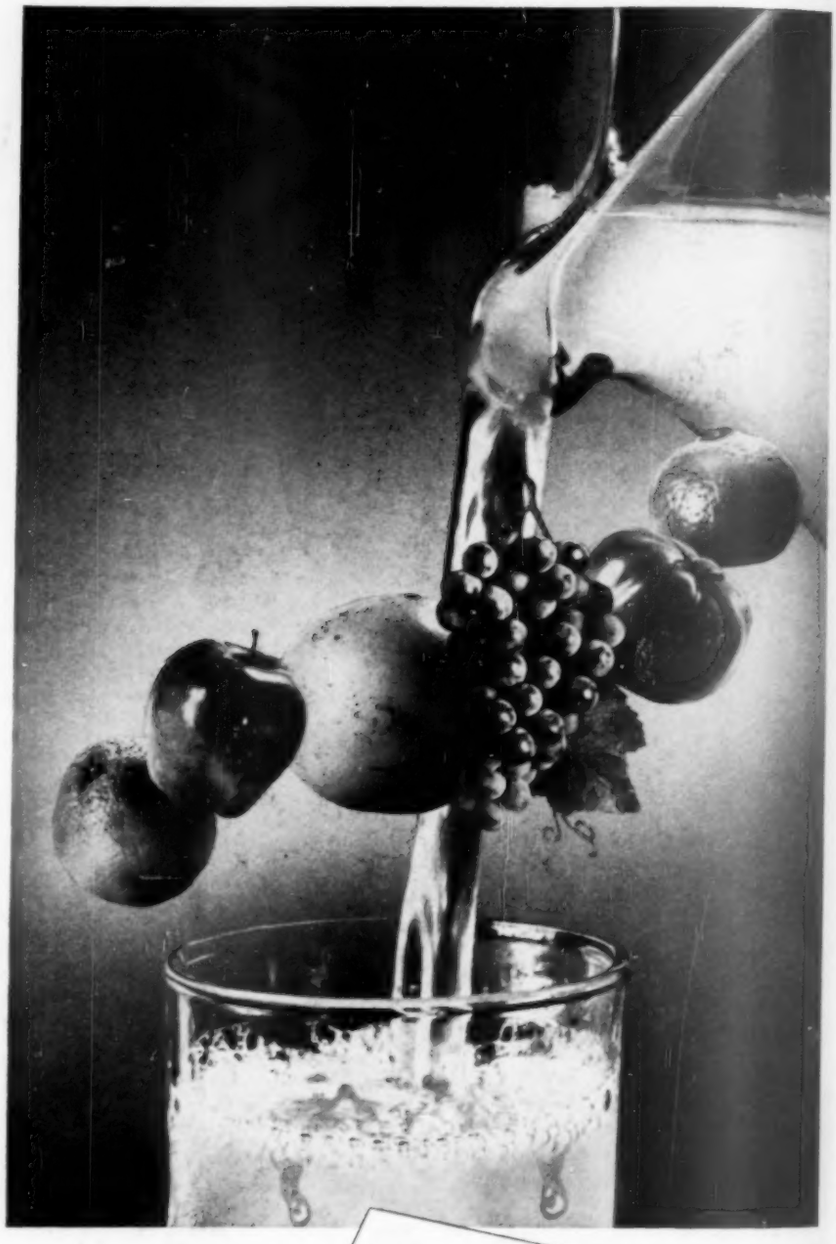

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Abstracts

(Continued from page 12 preceding technical papers)

Standard procedure used in Portugal is described, details being given of methods adopted for detn. of water, total ash, water-sol. ash, HCl-insol. ash, alky. of ash, aq. ext., tannin, caffeine, N, and artificial coloring matter. Results of numerous analyses carried out from 1937 to 1940 are given, as a result of which the following limits are suggested: water ⩾10-12%, total ash ⩾8-9%, HCl-insol. ash ⩾1.5% aq. ext. ⩾25%, caffeine ⩾1.5%, tannin ⩾7%.

An evaluation of the methods used for determining the baking quality of nonfat dry milk solids.

Larson, B. L., Jeness, R., Geddes, W. F., and Coulter, S. T. *Cereal Chem., 28,* 351-70 (1951).

To det. the effects of variations in the manufg. process upon the baking quality of nonfat milk solids and on the results of various methods which have been proposed for their evaluation, several samples of nonfat dry milk solids were prepd. Skim milk was preheated for 30 minutes at a series of temps. ranging from 145° to 195° F., condensed to about 40% solids, and subsamples were spray-dried, superheated and spray-dried, and roller-dried. All nonfat solids which were preheated at 145° and 155° F. were of poor baking quality even though those which were superheated and roller-dried received a high heat treatment. Phys. dough tests such as the farinograph and extensograph tests, and phys. tests on reconstituted milks such as viscosity and soly. index, measure mainly the degree of casein destabilization which results in increased water absorption, an effect produced during the superheating and roller drying processes, which has little relationshop to baking quality. The amt. of undenatured serum protein, detd. either by pptn. or by reducing group methods, was of most value as an index of the extent of the preheating treatment which the milk had received.

BIOLOGICAL SCIENCES

BIOCHEMISTRY

Protein structure and clinical problems.

Dodds, E. C. *Brit Med. J.*, Dec. 2, 1950; *Am. J. Digestive Diseases, 18,* 288 (1951).

The basic protein structure of enzymes, antibodies and hormones is discussed, as well as viruses and emphasis is made that the millions of complex protein molecules in the body are built to exact formulas by some, as yet, mysterious controlling mechanism. The whole protein of the body is replaced every 160 days. When the controlling mechanism finally is understood, we shall find the answer to many problems, possibly even the mechanisms of senescence and of cancer.

Studies of the reaction between proteins and reducing sugars in the dry state. IV. Decomposition of the amino sugar complex and the reaction of acetylated casein with glucose.

Lea, C. H. R., Hannan, S., and Rhodes, D. N. *Biochem. Biophys. Acta., 7,* 366-77 (1951).

The decompn. of a casein-glucose complex in which the glucose was attached almost exclusively to the protein amino groups (70% of the total) was studied in conjunction with the reaction between acetylated casein (contg. virtually no free amino groups) and glucose at 37° C. and 69% or 85% relative humidity. The complex browned rapidly, at a rate which indicated that decompn. of carbohydrate attached to the protein amino groups could account for most of the darkening of a casein-glucose mixt. at 37° C. The reducing power characteristic of the amino-glucose complex also decreased and insoly. developed, the change in each case being more rapid at 85% than at 69% relative humidity. Only a small proportion of the bound carbohydrate became dialysable, and practically no water was produced. Arginine disappeared extremely slowly, indicating that indirect reaction by cross-linking with carbohydrate already attached to amino groups was probably not an important factor in the casein-glucose system. Acetylated casein stored with glucose browned only very slowly at 37° C., confirming the importance of free amino groups in this process. Arginine (and apparently other non-lysine side chains) reacted with glucose, although more slowly than in casein, and ferricyanide reducing power increased. At 60° C. all 3 changes were accelerated about 20 times; very pronounced darkening occurred, much glucose combined with the protein and all the arginine groups were

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rapidly destroyed, notwithstanding the absence of free amino groups from the system. In the early stages of the reaction of casein with glucose at 37° C. and 69% relative humidity, approx. one mol. of water was liberated for each mol. of glucose reacting the ratio subsequently rising to 1.28 after 30 days and 1.5 after 80 days.

Influence of heat on some foods containing proteins.

HEINTZE, K. *Deut. Lebensm. Rundschau, 46,* 166-7 (1950); *Brit. Abstracts, BIII,* 95 (1951).

The improvement in the nutrititve value of soya beans on heating (moist at 108° C. for 20 min.) is due to the destruction of a trypsin-inhibitor. Beans, lentils, and soya beans (not peas) contain, in varying proportions, other thermolabile toxic substances of unknown compn. which are destroyed on boiling water for over 1 hr. Dry heat (high-frequency field) is less destructive to these bodies than is moist heat at the same temp.

The effect of mineral oil on food utilization. II. Changes of beta-carotene in mineral oil.

PAUL, M. F., ELLS, V. R., AND PAUL, H. E. *Am. J. Digestive Diseases, 18,* 278-82 (1951).

Stereoisomerization of beta-carotene is believed to occur both *in vitro* and *in vivo* in the presence of mineral oil. The lower biol. activity of the stereo-isomers may account in part for the deleterious action of mineral oil on carotene utilization.

The role of the B-vitamins, lysine, and tryptophane with respect to growth, the inactivation of the estrogens in the liver and sex physiology.

MENTZ, H. A., AND ODENDAAL, W. A. *S. African J. Med. Sci., 15,* 4, Dec. (1950); *Am. J. Digestive Diseases, 18,* 287 (1951).

In a study on rats maize was used as the basic foodstuff, supplemented with amino acids (lysine and tryptophane) and B-vitamins (natural and synthetic) and compared with fixed standard mixts. Maize as a sole food source causes starvation. The nutritional value can be improved by the addn. of lysine and tryptophane but is decreased by the addn. of synthetic B-vitamins alone. Although normal growth may be obtained by a synthetic B-vitamin mixt., this does not maintain normal sex functions. B-vitamins are possibly more essential for liver function with regard to estrogenic inactivation than the amino acids lysine and tryptophane. A balance between the members of the vitamin B-complex is essential for inactivation of optimal quantities of estrogens. Stimulation of growth increases utilization of vitamins essential for estrogenic inactivation. Yeast as a natural source of B-vitamins is of more value than synthetic mixts. A balance must exist in the diet between proteins and vitamins which stimulate growth.

Occupational poisoning by trichloroethylene.

FORSSMAN, S. *Arhiv. hig. rada 1,* 257 (1950); *Arch. Ind. Hyg., 4,* 407 (1951).

Trichloroethylene is widely used as a solvent in various industries. Among the chlorinated hydrocarbons it is one of the least toxic.

Chemicals in foods: A report to the Association of Food and Drug Officials on current developments. Part II. Pesticides.

LEHMAN, A. J. *Assoc. Food and Drug Officials U. S., Quart. Bull., 15,* 122-33 (1951).

Acute oral toxicity data for 86 pesticides are given.

Photographic fundamentals of autoradiography.

HERZ, R. H. *Nucleonics, 9* (9), 24-39 (1951).

A review of the basic concepts and technics of autoradiography.

MEDICINE

Iodine, thyroid linked with artery hardening.

DUNGAL, N. *Science News Letter, 60,* 185 (1951).

Lack of iodine in the diet plays an important part in hardening of the arteries. This fact was uncovered from comparisons of Icelanders and Austrians, the latter having a high incidence of goiter from lack of iodine. Over 2000 autopsies have revealed that Icelanders have less hardening of the arteries, particularly the aorta, than people from the goiter region of Austria. In

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Austria marked calcification is often seen in persons in their fifties.

Stiff joints limbered by vitamin treatment.

KAUFMANN, W. *Science News Letter, 60,* 184 (1951).

Doses of niacinamide, the anti-pellagra vitamin, improved the general health of older patients. Joints stiffened by age could be moved better and sometimes returned to full range of motion. Withdrawal of the vitamin caused the joints to restiffen.

B vitamin clears confused old minds.

FLEETWOOD, J. *Science News Letter, 60,* 199 (1951).

The pellagra-preventive B vitamin can help old people whose mentality is affected because of hardening of their brain arteries. Patients whose symptoms were chiefly depression, confusion, and irritability improved considerably. Those in whom high blood pressure was marked showed little or no change.

Treatment of canine coccidiosis.

ALTMAN, I. E. *J. Am. Vet. Med. Assoc., 119,* 207-9 (1951).

The use of aureomycin in the treatment of coccidiosis in 25 dogs is described. The administration of aureomycin controlled diarrhea within 48 hours. Clinical improvement was rapid. No evidence of toxicity regardless of dosage.

MICROBIOLOGY

A culture medium for detecting and confirming Escherichia coli in ten hours.

CHAPMAN, G. H. *Am. J. Pub. Health, 41,* 1381 (1951).

A culture medium based on the observation that *Escherichia coli* does not reduce triphenyltetrazolium chloride whereas other coliforms rarely fail to do so. On this medium *E. coli* produce greenish yellow colonies surrounded by a yellow halo. Other coliforms produce dark red colonies.

Streptomycin resistance of coliform bacteria from turkeys fed streptomycin.

STARR, M. P., AND REYNOLDS, D. M. *Am. J. Pub. Health, 41,* 1375-80 (1951).

The use of streptomycin as a growth promoting supplement in turkey poults results in the appearance within three days of streptomycin-resistant coliform bacteria. In 66% of the drug-fast strains, resistance to the antibiotic rose to 60,000 μg. per ml. The potential hazard to veterinary and public health stemming from the indiscriminate use of antibiotic poultry-feed supplements is discussed.

Disinfection of the skin.

PRICE, P. B. *Drug Standards, 19,* 161-72 (1951).

The flora of the skin consists of three sorts of bacteria: transients or contaminants, superficial residents, and deeply situated residents. The various tests used to evaluate skin disinfectants are reviewed critically. The only test available at the present time which reproduces the conditions of actual use is the serial basin, hand washing test. Alcohols, mercurials, benzalkonium chloride, G-11 (hexachlorophene), and detergents are discussed.

NUTRITION

Antibiotics in agriculture.

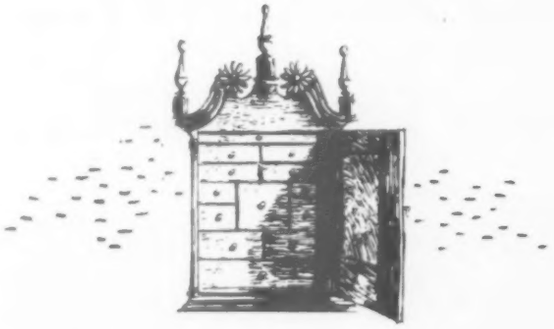
LAZIER, W. A. *Soybean Digest, 11* (8), 16-17, 1951.

Antibiotics, such as terramycin, aureomycin, penicillin, and streptomycin with vitamin B_{12}, when used as feed supplements, stimulate the rate of growth in young pigs and poultry as much as 15-20% over and above that produced by vitamins. Antibiotics for feed purposes are cheap since they do not require an expensive refining operation.

Effect of nicotinic acid, vitamin B_{12}, and aureomycin on growth of pigs and on resistance to artificial infection from Salmonella choleraesuis.

POWICK, W. E., ELLIS, N. R., DALE, C. N., AND ZINOBER, M. A. *J. Animal Sci., 10,* 617-23 (1951).

The addn. of nicotinic acid resulted in the usual highly significant stimulation of growth. The addn. of vitamin B_{12} was without effect. The addn. of aureomycin resulted in a highly significant stimulation of growth sharply limited to the first 3 weeks of the expt. Feeding of a broth culture of *Salmonella choleraesuis* at the end of the sixth week of the expt. produced little effect on any of the pigs and no significant differences in response that could be related to the dietary treatments.



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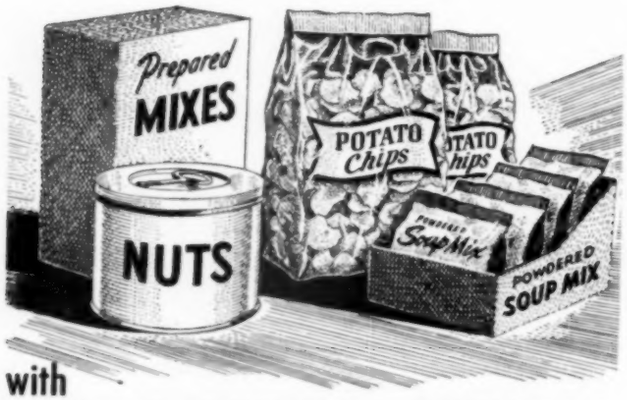

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FOOD TECHNOLOGY

CEREALS AND GRAINS

The distribution of thiamine and riboflavin in rice grains; and of thiamine in parboiled rice.

SIMPSON, I. A. *Cereal Chem., 28,* 259 (1951).

The distribution of thiamine and riboflavin in rice grains has been studied by the photographic method, first developed by Somers and his colleagues, for locating these vitamins in wheat kernels; some examples of the photographs obtained are presented. The results confirm that the max. concn. of both thiamine and riboflavin occurs in the germ or embryo; but, whereas thiamine is largely concd. in the scuttellum and the adjacent cells of the endosperm, riboflavin appears to be more uniformly distributed throughout the tissues of the embryo. The method has also been applied to observe the changes that occur in the distribution of thiamine in rice grains during the parboiling process. The results show that, under certain conditions, considerable diffusion of thiamine from the scutellum and pericarp tissues into the endosperm takes place.

FATS AND OILS

Use the fats that fit your mixes.

CARLIN, G. T. *Food. Eng. 23* (7) 113 (1951).

Care in the selection of antioxidants is stressed.

Effect of antioxidants on orange oil.

KENYON, E. M., AND PROCTOR, B. E. *Food Research, 16,* 365-71 (1951).

Of the 5 antioxidants studied, alpha-tocopherol and nordihydroguaiaretic acid (NDGA) appeared to offer the most promise for use with orange oil and possibly other citrus oils. Propyl gallate was more effective as an antioxidant than ethyl gallate, but both were less effective than alpha-tocopherol and NDGA. Guaiacol, although effective, should probably not be used as an antioxidant for orange oil, because of its strong characteristic odor and its possible toxicity.

Solvent extraction of cocoa butter.

REEVES, R. V. *Chem. Eng., 58* (7) 254-9 (1951).

Flow diagram and explanation is presented indicating how the Hershey Co. performs this operation.

FISH AND SEAFOOD

Control of rancidity in stored fish. IV.

TARR, H. L. A., SOUTHEALT, B. A., AND BESSETT, H. M. *Fisheries Research Board Can., Progress Repts, Pacific Coast Sta., 88,* 67-9 (1951).

The ability of ascorbic acid to retard rancidity in cold-stored fish is discussed.

Plant sanitation. Circular No. 22.

Fish Inspection Laboratory, Halifax, Nova Scotia, Canada, July 5, 1950. *World Fisheries Abstracts, 2,* 13-14, May-June (1951).

Plant sanitation is achieved by cleansing and sanitizing. The cleansing includes complete removal of visible dirt by hosing, a scrubbing of the working surfaces with water 130° F. and a cleansing agent, and by rinsing with boiling water. The heat allows metal surfaces to dry rapidly, thus preventing rusting. Sanitizing involves sterilization of working surfaces and utensils after they have been cleaned. Sterilization of working surfaces, floors, walls and drains, can be achieved by using chlorine soln.

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or by hosing with live steam. The problem of the personal hygiene of the plant's employees and of general sanitation including cleanliness of boats, trucks, wharves, stages, bait houses, plant surroundings, offal removal, and water supply, are discussed briefly. A guide to daily plant sanitation is given.

Studies on methods of handling frozen salmon for canning. *Com. Fisheries Rev., 13* (8), 8 (1951).

Exposure of frozen fish to oxidation and desiccation and length of frozen storage are the most important factors affecting the quality of the canned product. Frozen salmon must be heavily glazed and stored not over 6 to 8 weeks at 0° F. in order to minimize adverse changes of color, texture, and flavor in the canned product. Within practical limits, the rate of freezing and temp. of storage below 0° F. were not important factors.

FROZEN FOODS

What's new in concentrates?

HILBERT, G. E. *Quick Frozen Foods, 14* (9), 55-6 (1951).

Most important developments seems to be use of volatile-flavor essence in making frozen concd. fruit juices. These essences consist of the volatile flavoring constituents of the fruit, which are recovered from the juice during concn. and returned to the final product just before freezing. This process differs from citrus fruit concentrates which, concs. the juice to a high Brix and then cuts back the Brix by use of single strength fresh juice. The process of using this essence type of addn. has use in apple and grape juice concs. It may also be useful in frozen concd. tomato juice.

Engineering advances freeze-concentration.

LAWLER, F. K. *Food Eng., 23* (10) 68-71 (1951).

"Step Freeze" process improved by new freeze-tanks that form small, clear ice crystals to reduce solids loss. Centrifuge removes ice in automatic operation.

Specific heats of foods.

Ref. Res. Found. Inform. Bull., 4, August 20, 1951.

Under the title "The refrigerating effect required to freeze fruits and vegetables," L. Riedel of Karlsruhe, Germany, has published charts on amts. of heat that must be removed from juices, fruits, and vegetables in the course of chilling and freezing.

JAMS AND JELLIES

Mechanized continuous process pays six extra benefits.

MILLER, I. C. *Food Eng., 23,* 103-06 (1951).

Precise Reich method employs controls that take guess out of jam, jelly, marmalade and preserve production. Makes uniform high quality products non-stop at one-fourth batch labor cost. Flow sheet included.

Rich powder from papaya.

KING, G. S., SAKANASHI, H., AND SONG, E. *Food Eng., 23,* 147 (1951).

A dry fruit powder of fine flavor and notable for its content of pectin, minerals and vitamin C is now being processed from papaya fruit at the Hawaii Agricultural Experiment Station, Honolulu, T. H. A market has already been found for the new powder as a supplement in infant cereals. Other likely uses are as flavoring for beverages, ice cream, and jellies.

MILK AND MILK PRODUCTS

Determination of heat produced reducing substances in milk with porphyrexide.

STEWART, JR., A. P. *J. Dairy Sci., 34,* 743-8 (1951).

A method has been developed for measuring heat-produced reducing substances in milk products. The method employs a powerful oxidizing dye, porphyrexide, in conjunction with an indicator, *p*-aminodimethylaniline sulfate. In preliminary tests its usefulness is indicated by its measurements of relatively large amts. of reducing substances in various milk products where heat is employed in processing. Other tests have shown the method to give results which correlate well with cooked flavor.

Aseptic canning makes miracle milk a reality.

Western Canner and Packer, 43 (7) 17-20 (1951).

Aseptic canned milk cannot be distinguished from fresh. It maintains good flavor for 30 days at room temp. and almost indefinitely under refrigeration. Production is being taken by the Army for Alaska and Japan. The Graves-Stambaugh patents are used. From the time the milk leaves the cow until the can is sealed it is held under vacuum. The milk is flash heated for 8 seconds at 280° F.

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STARCH

Triesters of corn starch, amylose, and amylopectin properties.

WOLFF, I. A., OLDS, D. W., AND HILBERT, G. E. *Ind. Eng. Chem., 43,* 911-14 (1951).

The melting ranges, plastic properties, viscosities, x-ray diffraction patterns, film characteristics, and possible uses as lacquer-type protective coatings are reported.

INDUSTRIAL CHEMISTRY

What does maintenance cost?

LEONARD, J. D. *Chem. Eng., 58* (9) 149-53 (1951).

Cost data are presented which are useful to est. maintenance costs for new plants and sharpen up cost-reduction programs for old plants. Each piece of chem. equipment is considered separately and the maintenance cost is given on the basis of capacity.

The planning of libraries for military research establishments.

HERNER, S., AND HEATWOLE, M. K. *Science, 114,* 57-9 (1951).

Staff and cost estimates for planning and maintaining a library serving 300-400 technical personnel are discussed.

PACKAGING

The permeation of vapors through polyethylene.

CUTLER, J. A., KAPLAN, E., MCLAREN, A. D., AND MARK, H. *Tappi, 34,* 404-1 (1951).

The data are limited to the vacuum permeation of a no. of vapors through polyethylene. A new empirical relationship for the permeation const. is evident from the results of the study.

Safe stacking life of corrugated boxes.

KELLICUTT, K. Q., AND LANDT, E. F. *Fibre Containers, 36* (9) 28-38 (1951).

A method is described whereby it is possible to predict stacking life of corrugated boxes. Effect of humidity is also described.

PHYSICAL RESEARCH

X-ray powder patterns of nucleic acid derivatives.

CLARK, C. *Archi Bochem. Biophysics, 31,* 19-28 (1951).

Debye-Scherrer X-ray powder patterns of 14 natural nucleic acid derivs. are presented with a discussion of the X-ray method of identification of unknown nucleic acids.

PATENTS (U. S. A.)

Prevention of enzymatic discoloration of potatoes.

SCHADE, A. L. Assignor to U. S. A. 2,569,075, September 18, 1951.

A process for the prevention of enzymatic potato discoloration, comprising immersing a peeled potato in an electrically conductive liquid having a resistance to an elec. current below the resistance of an uncooked peeled potato and above the resistance of a cooked peeled potato to elec. current, and passing a high-frequency alternating elec. current through liquid and through potato, until potato is cooked.

Method of measuring the pH of aqueous liquids, moist foodstuffs and the like.

PARKER, E. W. 2,567,445, September 11, 1951.

The process of measuring the pH of aq. liquids, moist foodstuffs and the like, which comprises holding in direct contact with a moist material whose pH is to be measured a thin body of transparent, semi-permeable, hydrophilic, water-insol. colloidal plastic having uniformly incorporated in the body thereof a pH indicator dye in a concn. within the range of from about 0.005 to 20% by wt.; dye changing color due to pH change over a range of pH including the pH of the material whose pH is to be measured; body of plastic being sufficiently thin to respond quickly to changes of pH when contacted with material and sufficiently porous to be permeable to hydrogen and hydroxyl ions but having pores sufficiently small substantially to hinder diffusion of the dye molecules; and comparing the color of plastic body with pH color standards after it has been held in contact with material for a time sufficient to assume a color corresponding to the pH of material.

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Dow Corning Corp.	17
Firmenich, Inc.	3rd cover
Florasynth Laboratories, Inc.	19
Food Development Laboratory	24
Food Machinery & Chemical Corp.	9
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CONTENTS

THE STORAGE LIFE OF FROZEN ORANGE CONCENTRATE FROM THE STANDPOINT OF THE CONSUMER. Erston V. Miller and Robert L. Marsteller 119

RELATION OF KETCHUP COLOR TO TOMATO COLOR AS DETERMINED BY THE HUNTER INSTRUMENT. Robert E. Buck and Ruth A. Sparks 122

THE BACTERIOLOGY OF GULF COAST SHRIMP. IV. BACTERIOLOGICAL, CHEMICAL, AND ORGANOLEPTIC CHANGES WITH ICE STORAGE. L. Leon Campbell, Jr., and O. B. Williams 125

DEVELOPMENT OF OFF-FLAVOR IN 20° BRIX ORANGE CONCENTRATE INOCULATED WITH CERTAIN STRAINS OF LACTOBACILLI AND LEUCONOSTOC. D. I. Murdock, V. S. Troy, and J. F. Folinazzo 127

EFFECT OF SUBTILIN AND STREPTOMYCIN ON THE FORMATION OF NITRIC OXIDE HEMOCHROMOGEN IN COOKED GROUND FRESH BEEF. Etheleen Hugli and Inez Prudent 129

THE CLARIFICATION OF APPLE JUICE BY FUNGAL PECTIC ENZYME PREPARATIONS. M. A. Joslyn, S. Mist, and E. Lambert 133

SELECTION OF SENSORY TESTING PANELS. Norman F. Girardot, David R. Peryam, and Ruth Shapiro 140

THE USE OF WHEY PROTEIN IN PROCESS CHEESE PRODUCTION. J. Babad, J. Avidor, N. Sharon-Shtrikman, and A. Grünpeter 143

THE SOURCE OF BACTERIA IN PROCESSING AND THEIR SIGNIFICANCE IN FROZEN VEGETABLES. G. J. Hucker, Robert F. Brooks, and Arthur J. Emery 147

MICROBIOLOGY OF FROZEN ORANGE CONCENTRATE. I. SURVIVAL OF ENTERIC ORGANISMS IN FROZEN ORANGE CONCENTRATE. Saul S. Hahn and M. D. Appleman 156

BOOK REVIEW 158

NOTES AND LETTERS 159

REGIONAL SECTION NEWS *8*

SELECTED ABSTRACTS *24*

Authors of papers intended for publication in FOOD TECHNOLOGY should request from the editorial office a copy of the booklet, entitled "Information and suggestions to authors." Manuscripts submitted for publication in FOOD TECHNOLOGY should follow the style described in this booklet.

The Institute of Food Technologists assumes no responsibility for statements in contributed articles appearing in FOOD TECHNOLOGY. Editorials present only opinions of the writers and do not necessarily reflect policies of the Institute of Food Technologists.

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THE MONSANTO PRESENTATION AWARDS

The Monsanto Chemical Company offers four successive annual awards of $100.00 to be presented by the IFT at its annual meeting. These awards are to be known as the Monsanto Presentation Awards.

Dr. Russell L. Jenkins, Director of Research, Monsanto Chemical Company, defines the awards as follows: "We should like to offer four successive annual $100 awards to be known as the Monsanto Presentation Awards for the papers at the annual meeting which are best presented. This would include effective delivery, clarity of illustrative material and audience interest, but not necessarily context, though this should have a direct bearing. It is our hope that these awards will crate an incentive for effective paper presentation and thus have a buoyant effect on the tenor of the meeting."

The letter covering information concerning the awards was submitted May 24, 1951, prior to the Eleventh Annual Meeting. The first award was to be presented at this meeting. However, the administration of the awards proved to be a difficult problem, and adequate procedures could not be developed or organized during the limited time available at the Eleventh Annual Meeting. Consequently, presentation of the first award was postponed until 1952.

Dr. Philip K. Bates of Riker Laboratories, Los Angeles, California, has been appointed Chairman of the committee to outline the procedure to be followed implementing the award. A copy of his report covering the outline of the procedures will appear in Food Technology.

The President and Council, on behalf of the membership of the IFT, take this opportunity to express their sincere appreciation of the interest and good will of the Monsanto Chemical Company in placing this award with the Institute.

USE OF TRADE NAMES IN ARTICLES PUBLISHED IN FOOD TECHNOLOGY AND FOOD RESEARCH

The combined Editorial Boards of Food Research and Food Technology have formulated the following policy for the use of trade names in articles published in the Institute's journals:

1. Trade names are to be avoided in defining products dealt with, except where in the judgment of the editor the maximum value of the paper cannot be otherwise retained.
2. If trade names are used for any of the commodities compared, all of the commodities having trade names should be so designated, if practicable.
3. If trade names are used, the commodities in question must be described in sufficient detail to make the nature of such products sufficiently clear to professionally trained readers.

This policy was approved by the Executive Committee of the Council on November 30, 1951, and subsequently by the Council of the IFT.

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The 1952 IFT Annual Meeting

PLANS FOR GRAND RAPIDS, MICHIGAN PROGRAM PROGRESSING

More than 35 members have been active during the past six months in developing the various parts of the technical program that is rapidly nearing completion for the Annual Meeting in Grand Rapids. The meeting will be held June 8-11.

The usual General Session on Monday forenoon, June 9th, will feature several top executives and administrators.

The Appert Award will be made by the Chicago Section following the banquet on Tuesday night. As a departure from custom, the technical address of the recipient will be made at a second General Session just before the lunch hour on Wednesday.

The number of contributed titles for research papers at this writing warrants scheduling not less than three section meetings for their presentation. The subcommittee handling this portion of the program reports that the quality of the papers is excellent.

Titles for other half-day symposia are: Food Research Development, New Food Products, Utilization of Enzymes and Control of Enzymatic Reactions in Foods, Recent Developments in the Use of Flexible Materials in Food Packaging, Food Engineering, Sanitation, Prevention of Deterioration in Foods, Control of Microorganisms in Foods, Fermented Foods, Chemicals and Additives in Foods, Cereal Technology, Frozen Foods, Food Acceptance and University and Industry Relations.

In addition to the regular meetings of the IFT Council, Executive Committee, Editorial Board, and Section Officers, there will be scheduled meetings or luncheons or breakfasts of the Citrus Technologists, the Association of Food Industry Sanitarians and the University of Massachusetts Alumni.

The Ladies Entertainment Committee is planning a number of special events for the women who will attend the National Convention as guests of the members. Among the many activities will be a luncheon on Tuesday at the Blythfield Country Club, followed by an afternoon of optional activities—golf, bridge, etc.

Entertainment plans for IFT members on those evenings other than Tuesday, when the banquet will be held, are progressing nicely.

Plant trips are also being arranged. Watch the May issue of "Food Technology" for more details on these and other activities and for the complete program of the Annual Meeting.

SIMPLIFIED HOTEL RESERVATIONS FOR THE 1952 ANNUAL MEETING IN JUNE

One of the features of the 1952 Annual Meeting of the IFT at Grand Rapids, Michigan will be simplified hotel reservations.

Grand Rapids is unique in that one of the major hotels in the city, the Pantlind, is connected directly with the Convention Hall. Every one will want to have space in the Pantlind because of its convenience, although this of course, is not possible inasmuch as the hotel is not large enough to hold the entire attending membership. Because of this, an arrangement has been set up whereby all requests for hotel reservations will be addressed to the Pantlind hotel. As these requests for reservations are received, space in the Pantlind will be allocated on a first come, first serve basis and when the Pantlind is full, reservations will be turned over to the other major hotels in the city. All of the hotels are within a few blocks of the Convention Hall so that no hardship will be worked on anyone. Instead, those who make reservations early will have the added convenience of a direct connection with the Convention Hall.

Reservation cards from the Pantlind will be sent to all members within a few weeks, however, in the meantime, if any one wishes to assure space in the Pantlind it is suggested that they make reservations immediately.

The Pantlind is excellently set up for special entertaining requirements, having some sixty odd parlors, entertainment rooms, connected suites, etc. It is suggested that those who wish to make advance reservations write direct to Jack Ament, Reservations Manager, The Pantlind, Grand Rapids, Michigan.

FUTURE DATES FOR FOOD TECHNOLOGISTS

April 1-4	National Packaging Exposition, Atlantic City Auditorium, Atlantic City, N. J.
April 15-17	Research and Development Associates, Food and Container Institute, Inc., Palmer House, Chicago, Ill.
April 20-25	American Association of Cereal Chemists, National Convention, Adolphus Hotel, Dallas, Texas.
April 28-30	American Oil Chemists' Society, Spring Meeting, Shamrock Hotel, Houston, Texas.
May 11-15	Super Market Institute, Annual Super Market Convention, Cleveland Public Auditorium, Cleveland, Ohio.
May 25-28	Flavoring Extract Manufacturers' Association, Annual Convention, Edgewater Beach Hotel, Chicago, Ill.
June 1-5	National Confectioners' Association, Annual Convention and Exposition, Hotel Conrad Hilton, Chicago, Ill.
June 8-12	**Institute of Food Technologists, Twelfth Annual Meeting, Grand Rapids, Mich.**
June 19-22	American Plant Food Council, Annual Meeting, The Homestead, Hot Springs, Va.
June 24-26	American Dairy Science Association, Annual Meeting, Davis, Calif.
August 4-8	Food and Nutrition sessions, Gordon Research Conferences, AAAS, New London, N. H.
Sept. 29-Oct. 1	Association of Official Agricultural Chemists, Annual Meeting, Shoreham Hotel, Washington, D. C.

(Information concerning future dates of national and international meetings, conventions and exhibits of interest to food technologists should be sent to the editorial office.)

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B

Regional Section News

MOHAWK VALLEY SECTION

The officers of the Mohawk Valley Section for the current fiscal year are as follows:

Chairman: Wendell S. Phillips, Beech Nut Packing Co., Canajoharie, N. Y.
Vice Chairman: Harold Gordy, Beech Nut Packing Co., Canajoharie, N. Y.
Recording Secretary: Carl Nordgren, Little Falls, N. Y.
Corresponding Secretary: Norma Knapp, Beech Nut Packing Co., Canajoharie, N. Y.
National Councilor: A. S. Burhans, Polymer Laboratory, Beech Nut Packing Co., Canajoharie, N. Y.

MARYLAND SECTION

The January meeting of the Section was held at the Hotel Stafford, Baltimore, January 18, 1952, at which time new officers took over for the coming year. The officers for 1952 are:

Chairman: Basil W. Clarke, Crosse and Blackwell Company, Baltimore, Md.
Vice Chairman: Edgar Heyl, Crown Cork and Seal Company, Baltimore, Md.
Secretary: Arthur M. Kaplan, Bureau of Human Nutrition and Home Economics, U. S. Dept. of Agriculture, Beltsville, Md.
Treasurer: Charles S. Mason, Industrial Laboratories, Baltimore, Md.
Councillors: Amihud Kramer, University of Maryland, College Park, Maryland; A. H. Warth, Crown Cork and Seal Company, Baltimore, Md.
Elected to the Executive Committee—Francis J. Weiss, National Farmers Union, Washington, D. C.

Speakers at the meeting were Mr. Weld Conley and Mr. Lawrence Kaap of the Chain Belt Company of Milwaukee, Wisconsin, who spoke on the "Heating and Cooling of Canned Food Products Using End Over End Agitation." During the presentation excellent movies of the machinery and process used were shown to the members.

The February meeting was held February 8, 1952, at the Hotel Stafford in Baltimore. The speaker for the evening was Dr. Charles G. King, Scientific Director, Nutrition Foundation Inc., New York, N. Y., who spoke on "The Food Industry's Stake in Research."

In line with the policy of the Maryland Section to try to have various food concerns in the area submit a sample of their products for sensory appreciation by the members and guests, the January dinner was enjoyably augmented by National Premium Beer, courtesy the National Brewing Company, Baltimore, Md., and the February meeting was enhanced by various preserves (courtesy the Crosse and Blackwell Company, Baltimore, Md.) served during the meal.

NORTHEAST SECTION

The Section's March meeting, held in the Hotel Brunswick, Boston, Mass., on March 6th was labelled Ladies' Night; in fact, it was the first Ladies' Night of the season. Speaker for the occasion was Dr. Frederick J. Stare, Harvard School of Public Health, Brookline, Mass., who gave a talk on "Nutrition," discussing the need for food processing methods that will preserve at a maximum the nutritional value of foods. Dr. Stare also covered the nutritional approach to advertising and promotion of foods and the responsibility of food manufacturers to sell nutrition to the public.

(Continued on page 12)

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Edward Mackay Chace, 1952 Nicholas Appert Medal Award Recipient

Characterized as the "dean of citrus products technology in the United States," Edward Mackay Chace has devoted a lifetime of service to food technology. He was born at Havana, N. Y. (now Montour Falls) in 1874 and attended grade and high schools in Washington, D. C.

Edward Mackay Chace

Courses in chemistry at George Washington University and study of law at the National University Law School (L.L.B., 1906; L.L.M., 1907) prepared him well for his role in the food industry. This excellent legal training later guided Mr. Chace in his important work on standards for citrus products.

Mr. Chace worked as a sugar chemist for two seasons in Cuba and three seasons in Louisiana. He entered the U. S. Department of Agriculture in 1898, but was transferred to the Cuban Customs Service at Havana where he served as Chief Chemist. Returning to the U.S.D.A. in 1903, he advanced from Assistant Chemist to Principal Chemist in charge of the citrus by-products laboratory and the fruit and vegetable chemical laboratory. He retired from the Bureau in 1944 after 41 years of continuous service. In 1908, Mr. Chace was sent to Sicily by the U. S. Bureau of Plant Industry to survey the citrus fruit and citrus products business there. Application of his observations plus extensive research into citrus by-products laid the foundation for the vast citrus technology of Florida, California, Texas, and Arizona.

Work by Mr. Chace was instrumental in establishing the fundamental standards of maturity for many fruits and vegetables, and particularly for the citrus industry. At his recommendation, a laboratory was established in 1912 at Los Angeles to carry out the standardization work. Many of these standards formed the basis for food processing operations under the Federal Food and Drug laws. Mr. Chace extended his studies to the effect of ethylene gas on fruits, walnuts, and certain vegetables; canning and by-products of other fruits and vegetables; food chemistry and adulteration; essential oils; preservation of foods by freezing; and dehydration of fruits and vegetables. His scientific publications on these subjects are numerous.

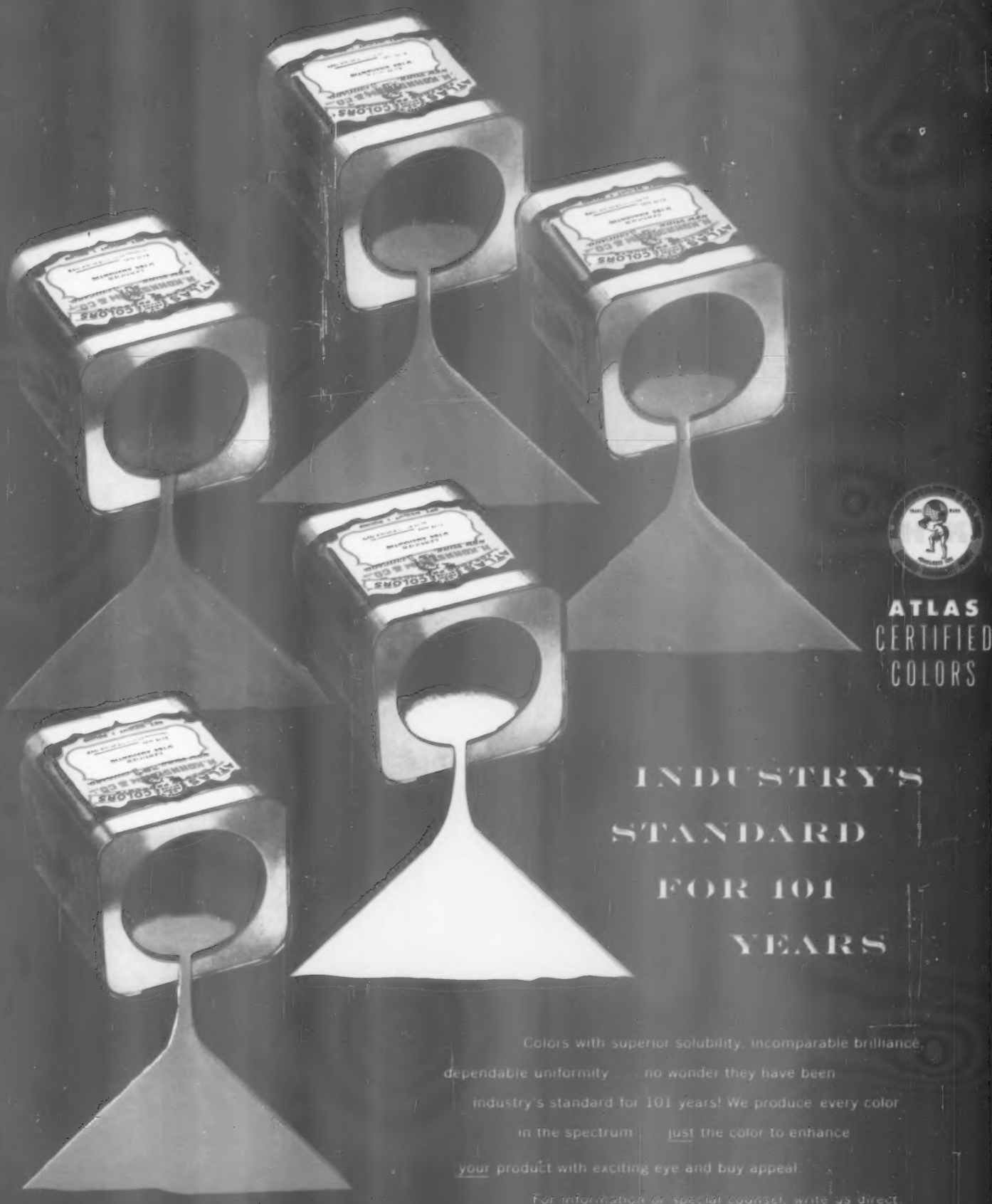
High official recognition came to him in the closing years of his service with the Federal government. In 1943, Mr. Chace was detailed to the Office of Economic Warfare. He was sent to Brazil to strengthen the agricultural ties of the United States and its Latin American neighbors by means of technological advice.

A charter member of the IFT, Mr. Chace has held the office of vice president. He served as a councilor for the American Chemical Society and was awarded its 50 year membership certificate. He also has held membership in the American Association for the Advancement of Science.

His valued services to the food industry profoundly qualify him for the Nicholas Appert award for "preeminence in and contribution to the field of food technology." The Award will be presented to Mr. Chace in June during the 1952 Annual Meeting of the IFT to be held in June at Grand Rapids, Michigan.

STATISTICAL SUMMER SESSION AT V. P. I.

The Department of Statistics and the Statistical Laboratory in cooperation with the Department of Mathematics and the Department of Industrial Engineering of the Virginia Polytechnic Institute will conduct a special statistical summer session, July 29 to August 15, 1952. The program will be for graduate students, research workers, and technicians in government and industry. Special offerings will be given in the statistics of taste testing, bio-assay, sampling and in engineering research and production. For further details write the Department of Statistics, Virginia Polytechnic Institute, Blacksburg, Virginia.



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BRANCHES IN OTHER PRINCIPAL CITIES OF THE U. S. A. AND THROUGHOUT THE WORLD

Regional Section News

(Continued from page 8)

It has been announced that the Section's Chairman, John Sjostrom, has been elected General Chairman of the 1953 National IFT Annual Meeting to be held in Boston.

OREGON SECTION

On February 5th, the Oregon Section met at a noon luncheon, in the Memorial Union, Oregon State College, Corvallis.

The members had the pleasure of meeting and listening to President Charles N. Frey and past president, William V. Cruess. Both were also present at the dedication of the new Food Technology Building, February 4th.

Dr. Frey spoke at the 31st Annual Canners' and Freezers' School on "Functional Additives in Modern Food Processing." Our past president, Dr. Cruess, spoke on "The Application of Research to the Canning Industry."

PHILADELPHIA SECTION

The Section's February meeting was held on the 21st at the Whittier Hotel in Philadelphia. Speaker for the occasion was Dr. Charles N. Frey, National IFT President, and his subject was "Chemicals in Foods."

WESTERN NEW YORK SECTION

The Section held its March meeting on February 27th at the New York State Institute of Applied Arts and Sciences, in Buffalo. The March meeting date was set during the last week in February because of difficulties in making arrangements for the regular meeting place.

Dr. N. E. Lazarus, President of Lazarus Laboratories, Inc., Buffalo, addressed the meeting, taking as his subject "Sanitation in the Food Industry."

AMES SECTION

The January meeting was an afternoon and evening session held in the Pine Room, Memorial Union, Iowa State College. At the afternoon session the following excellent papers were heard:

"Alcoholic fermentation by enzymes" by Dr. L. A. Underkofler, Chemistry Department, Iowa State College.

"An integrated broiler program" by Dr. Richard H. Forsythe, Armour and Company.

"Soybean oil extraction" by Dr. Lionel Arnold, Iowa State College.

"Research in the American Meat Institute Foundation" by Dr. H. R. Kraybill, Director of Research and Education, American Meat Institute Foundation, Chicago, Ill.

After a business meeting, members made a tour of the Chemical Engineering Building and inspected the equipment used in soybean oil extraction.

Dr. W. O. Lundberg, Executive Director, Hormel Institute, University of Minnesota was the dinner speaker. His subject was "Rancidity of Fats."

On April 18, 1952, a meeting will be held at Iowa State College. Plans include talks by Dr. Ralph Hixon on starch chemistry and Mr. C. F. Smith, Continental Can Co. on food canning. Mr. Ratner, Editor, *Better Homes and Gardens*, will talk on advertising food products, and Mr. Wegener on television. A demonstration is being planned on the preparation of bakery products. A business meeting will be held to elect officers.

GREAT LAKES SECTION

The next meeting of the Section is to be held in Grand Rapids, Mich., at the Pantlind Hotel, on April 25, 1952. Most of the day-time sessions will consist of committee meetings concerning the national Annual Meeting in June. All members of the Section are urged to attend. If you have not been assigned to any committee, pick out the one on which you would like to serve, and sit in on their meeting. The place and time of the various committee meetings will be listed in the Spring meeting announcement. H. C. Scott requested as many people as possible to help the Courtesy Committee. The April meeting will be climaxed by a dinner, and Dr. Bob Wilson, head of the Food Inspection Department of Detroit, Mich., will address the Section after dinner.

SOUTHERN CALIFORNIA SECTION

The Southern California Section of the Institute of Food Technologists held its Sixth Annual Conference at the Huntington Hotel in Pasadena, California, February 16, 1952.

The theme of the meeting was "Scientific Improvement of Food Products." In view of the current congressional hearings on the use of chemicals in foods and cosmetics, this proved an extremely interesting session. Harry J. Deuel, Jr., Chairman of the Southern California Section of the Institute of Food Technologists, and Dean of the Graduate School of the University of Southern California, opened the meeting and introduced Dr. Ernest Geiger as chairman of the day. The first paper was "Problems Resulting from the Use of Pesticides for Better Crop Production" presented by Dr. F. A. Gunther of the University of Southern California Experimental Station at Riverside. Dr. James Bonner of the California Institute of Technology followed with a discussion on the "Chemical Control of Crop Production."

(Continued on page 16)

Taken during the Southern California Section Meeting on February 16, this picture shows, from left to right, Charter Member P. K. Bates, Treasurer of the IFT (national); Charter Member Samuel Cate Prescott, IFT President 1940-42, Nicholas Appert Award Medal recipient, 1943; Charter Member E. M. Chace, announced to be recipient of the Nicholas Appert Award Medal for 1952; and H. J. Deuel, Chairman of the Section.

10-MINUTE RECIPE FOR BAKING A CAN

For a long time it's been known that certain foods taste better, keep better in a can that's coated inside with enamel. But it used to take this enamel a long time to dry. That made the cans more expensive than they should be.

So Continental research people went to work to find can linings that would dry and cure quickly. After extensive study, they developed several such linings. Applied to sheets of can metal, the new enamels dried six times faster than those first used, and three times faster than many used more recently. Now we can have sheets ready to be made into cans after only eight to ten minutes in the bake oven.

But our scientists are keeping right on working. Their new goal is enamels that will dry in one or two minutes and make lined cans even more economical.

Here's another example of what Continental is doing to provide better protection for packaged products—at lower cost. No matter how satisfactory the present performance of our cans, paper containers and fibre drums, our aim is to make the best even better.

(This advertisement originally appeared in full-color in TIME, BUSINESS WEEK and FORTUNE.)

CONTINENTAL CAN COMPANY

CONTINENTAL CAN BUILDING — 100 E. 42nd ST., NEW YORK 17, N. Y.

Regional Section News

(Continued from page 12)

During the afternoon session, Dr. Deuel discussed the "Chemical Control of Oxidation and Flavor Reversion in Food Products." Following Dr. Deuel's talk, Dr. R. R. Williams of the Research Corporation, New York, presented a color film on "Rice and Health." This film, which was shown for the first time, outlined the program of Vitamin Fortification of Rice in the Philippine Islands. Stanford Research Institute's Dr. Norman F. Johnston presented a paper on the "Versatility of Surface-Active Agents in Foods." Dr. Maynard A. Joslyn, University of California at Berkeley, followed with a paper entitled "Chemical Improvement of Food Acceptability." The dinner address was given by Arthur A. Dickerman, Attorney for the United States Food and Drug Administration, who discussed the legal aspects of adding substances to foods.

This special program was arranged to further the following objectives of the Southern California Section of the Institute of Food Technologists: to facilitate interchange of ideas among its members; to stimulate scientific investigations into technical problems dealing with the manufacture and distribution of foods; to promulgate the results of research in food technology; to offer a medium for the discussion of these results; to plan, organize and administer projects for the advancement and application of science insofar as it is fundamental to a wider knowledge of foods; and to encourage food manufacturers to employ qualified food technologists in the technical direction of manufacturing and distributing operations.

DIXIE SECTION

At the February meeting of the Dixie Section, Mr. Carl D. Pratt, Director, Technical Division, Industrial Chemicals Division, Atlas Powder Company spoke on "The Use of Emulsifiers in Foods." Mr. Pratt is a member of the Philadelphia Section, IFT.

A separate meeting is not planned for the month of April as the Georgia Acadamy of Science, the Georgia Section of the American Chemical Society, and the Southeastern Biologists are meeting in Atlanta April 18-19, and the majority of our members participate in at least one of these.

The May meeting of the Dixie Section will be held in Atlanta on May 9. Dr. R. S. Ingols, Research Professor of the Georgia Institute of Technology will talk in the evening on "Problems of Water Treatment." The evening program will be held at the Georgia Tech dining hall; the afternoon program will consist of tours of the Atlanta water purification plants.

Election of section officers will be held at the May meeting.

PERSONNEL

CHARLES N. FREY, President of the IFT, on February 5 addressed the Oregon Section of the IFT at Corvallis and also the meeting of the Frozen Foods and Canners Association held in the new Food Technology Building at Oregon State College. To the latter group he spoke on "Chemical Additives in Foods." On February 11 he addressed the faculty and students of the Department of Food Technology of the University of California, at Davis on the subject "The Progress of the Institute of Food Technologists." On February 21 he talked to the Philadelphia Section of the IFT on the subject, "Chemical Additives in Foods."

EDWARD L. HOLMES, formerly Director of Sanitation at the American Institute of Baking in Chicago, Ill., has been appointed Executive Director of the newly formed American Sanitation Institute, a division of The Huge Company, Inc., both in St. Louis, Missouri. The new consulting firm is to offer its services to the food industries on plant sanitation and related subjects. Dr. Holmes obtained his Ph.D. degree from McGill University and has other degrees from the Ohio State University and Yale University Graduate School.

OBITUARY

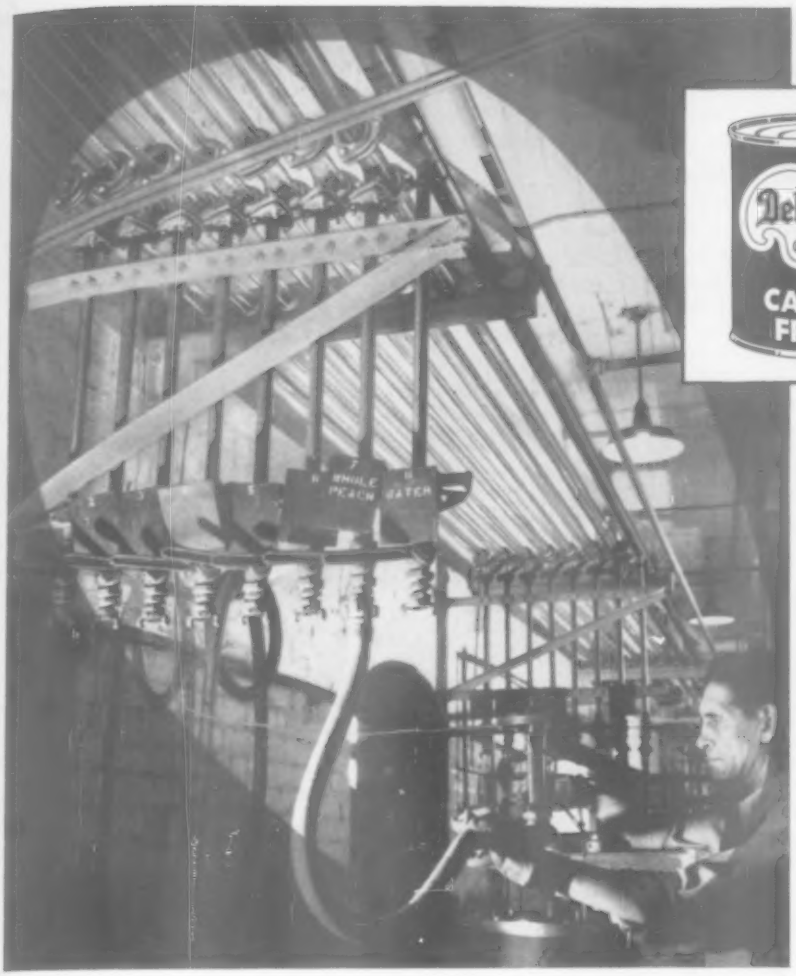
F. F. FITZGERALD, a Founder Member of the IFT and for many years Director of Research of the American Can Company, died on February 7 at Joliet, Ill. Before joining the American Can Co., Dr. Fitzgerald was with the U. S. Department of Agriculture and the National Canners Association. Under his leadership, the Research Department of the American Can Company expanded from a few chemists to a staff of over two hundred. He was well known for his important contributions to the processing of canned foods, vacuum packing, can coatings, and many other subjects related to canning. Dr. Fitzgerald retired in 1942.

DEDICATION OF BABCOCK HALL AT THE UNIVERSITY OF WISCONSIN

Named after the famous pioneer in Agricultural Science, Stephen Moulton Babcock, who sent some of America's most illustrious biochemists on the trail of causes of hidden hunger, Babcock Hall was formally dedicated at the University of Wisconsin on Thursday, February 7, 1952. The dedication was attended by members, and representatives of the dairy and food industries, and associations from over the state. An "open house" for visitors was held in conjunction with the dedication ceremony.

Babcock Hall houses the Department of Dairy and Food Industries of the College of Agriculture. In it are the very modern facilities for the teaching, research, and extension work conducted in the respective areas of food technology by the department. Costing 2½ million dollars, the building has on its lower floor the food industries section, on the second floor the general laboratories and class rooms, and on the third the dairy products research facilities. In the form of a T, the cross structure has a completely equipped dairy plant for the manufacture of various types fo dairy products.

The food industries section, under the direction of Dr. K. G. Weckel, offers a four-year, and graduate work curricula in food technology. It contains 17 rooms, including the following: large pilot food products processing room; bakery and confectionary processing laboratory; student products analysis laboratory; equipment storage room; shop room; class room; food products consumer acceptance test laboratory; two food products research laboratories; three temperature-controlled rooms for fermentation processing; raw products and packaged products storage; two freezer rooms; supplies and ingredients storage room; products smoking room; and staff office and library.



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Selected Abstracts[a]

ANALYTICAL METHODS

Differentiation of amylopectin, amylodextrins, and amylose-fatty acid complexes.

NUSSENBAUM, S. *Anal. Chem., 23,* 1478 (1951).

Various polysaccharides, amylodextrins, amylopectin, and amylose-fatty acid complexes form purple color complexes with iodine. This similarity and the difficulty of applying more exhaustive tests have led to confusion especially in enzymatic work, where the particular polysaccharide present is used to identify the nature of the enzyme. It was found that these closely related polysaccharides could be distinguished from one another easily by means of a spot test. When these compds. are paper-chromatographed, with formamide as solvent, the spots at the origin are characteristic for each compd. The mol. wt. of amylopectin can be approximated by comparison with standards. This test can be applied rapidly on very small amts. of material and without elimination of most impurities such as salts. It should be particularly useful in enzymatic work.

Determination of small amounts of 2,4-dichlorophenoxyacetic acid in milk.

MARQUARDT, R. P., AND LUCE, E. N. *Anal. Chem., 23,* 1484 (1951).

An accurate method for detg. low concn. of 2, 4-dichlorophenoxy-acetic acid (2, 4-D) in foodstuffs has been developed. The 2, 4-dichlorophenoxy-acetic acid is sepd. from the other constituents of milk. It is then heated with 1, 8-dihydroxy-naphthalene-3, 6-disulfonic acid (chromotropic acid) in a concd. sulfuric acid soln.; the wine-purple color thus produced is measured in a spectrophotometer. Concns. of less than 0.2 p.p.m. of 2, 4-D (0.1 mg. per pint of milk) can be detd. by this procedure.

A recording Warburg apparatus.

ARNOLD, W., BURDETTE, E. W., AND DAVIDSON, J. B. *Science, 114,* 364-7 (1951).

A description of a simple and relatively inexpensive modification of the method that gives a graphical recording of the data.

BIOLOGICAL SCIENCES

BIOCHEMISTRY

The bacterial oxidation of tryptophan: A study in comparative biochemistry.

STANIER, R. Y., HAYAISHI, O. *Science, 114,* 326 (1951).

As discovered independently by several workers, the analysis of adaptive patterns is of much value in the study of microbial metabolism. This technic (sometimes referred to as "simultaneous adaptation" or as "successive adaptation") is essentially an extension and refinement of the technic of kinetic analysis, and may be used to study the course of any microbial metabolic process that is under adaptive enzymatic control. One of the specific problems that has been investigated primarily by the analysis of adaptive patterns is the pathway for the complete oxidation of tryptophan by bacteria belonging to the Pseudomonas group.

Heat inactivation of the basic amino acids and tryptophan.

EVANS, R. J., AND BUTTS, H. A. *Food Research, 16,* 415 (1951).

In these expts. only one method of heating, namely, autoclaving for 4 hours at 15 p.s.i.g. pressure was used. Three types of inactivation of the basic amino acids and tryptophan occurred when a complex protein concn. such as soy bean meal, was autoclaved. These were: 1, a reaction of the protein-bound amino acid with either glucose or sucrose to destroy the biol. activity of the amino acid; 2, a reaction of the protein-bound amino acid with some other constituent of the protein to form a linkage resistant to *in vitro* digestion with trypsin and erepsin but not to acid hydrolysis; and 3, a reaction of the protein-bound amino acid with sucrose or glucose to form a linkage with properties similar to type 2. Dextrin, agar-agar, gum arabic, or soy bean oil played little or no part in the inactivation. Lysine inactivation was of types 1 and 2, arginine was of types 1 and 3, histidine was of all three types, and tryptophan was 1 and 3. Lysine appeared to suffer the greatest destruction and histidine and tryptophan the least.

Temperature-dependent characteristics of an adenylpropheophatase preparation from potatoes.

LEE, K. H., AND EILER, J. J. *Science, 114,* 393 (1951).

A phosphatase isolated from potatoes is described which possesses the property of catalyzing the hydrolysis of the 2 acid-labile phosphates in ATP at temps. above 7° C. Below 7° it catalyzes the hydrolysis of only the terminal group.

Some properties of an ascorbic acid oxidation inhibitor in vegetables.

BRANTHOOVER, B. J., AND HARD, M. MCGREGOR. *Science, 114,* 296 (1951).

Some of the properties of an inhibitor of ascorbic acid oxidation in snap beans are reported.

The antihypertensive influence of certain sulfhydryl compounds.

SCHROEDER, H. A. *Science, 114,* 441 (1951).

To evaluate the discriminative effect of a compd., depression of diastolic pressure 12 mm. Hg. or more 20 min. after injection was chosen as the criterion. The administration of certain sulfhydryl compds. of simple mol. structure can cause temporary lowering of blood pressure in exptl. and human hypertension without affecting normal blood pressure similarly. Furthermore, the pressor action of a no. of naturally occurring amines is markedly depressed.

Studies in experimental atherosclerosis.

POLLAK, O. J., AND WADLER, B. *J. Gerontology, 6,* 358 (1951).

The macromolecular-colloidal theory of atherosclerosis received support from expts. Exptl. results lead to the belief that plasmatic dyscolloidity can initiate atherosclerotic intimal alterations. Exptl. results imply that initial atherosclerosis represents an acute defense mechanism of the blood vessels to pptn. of macromicels from the blood stream and that the disease as observed in old age represents the cumulative results of such episodic reactions.

The percutaneous absorption of water vapor.

DELONG, C. W. *Science, 114,* 397 (1951).

The abdominal skins of rats were exposed to an atm. of tritium-labeled water vapor. It was indicated that rats absorbed approx. 2,000 mg. of water per min. from an atm. satd. with water vapor.

Degradation of labeled propionic and acetic acids.

PHARES, E. F. *Arch. Biochem. Biophysics, 33,* 173 (1951).

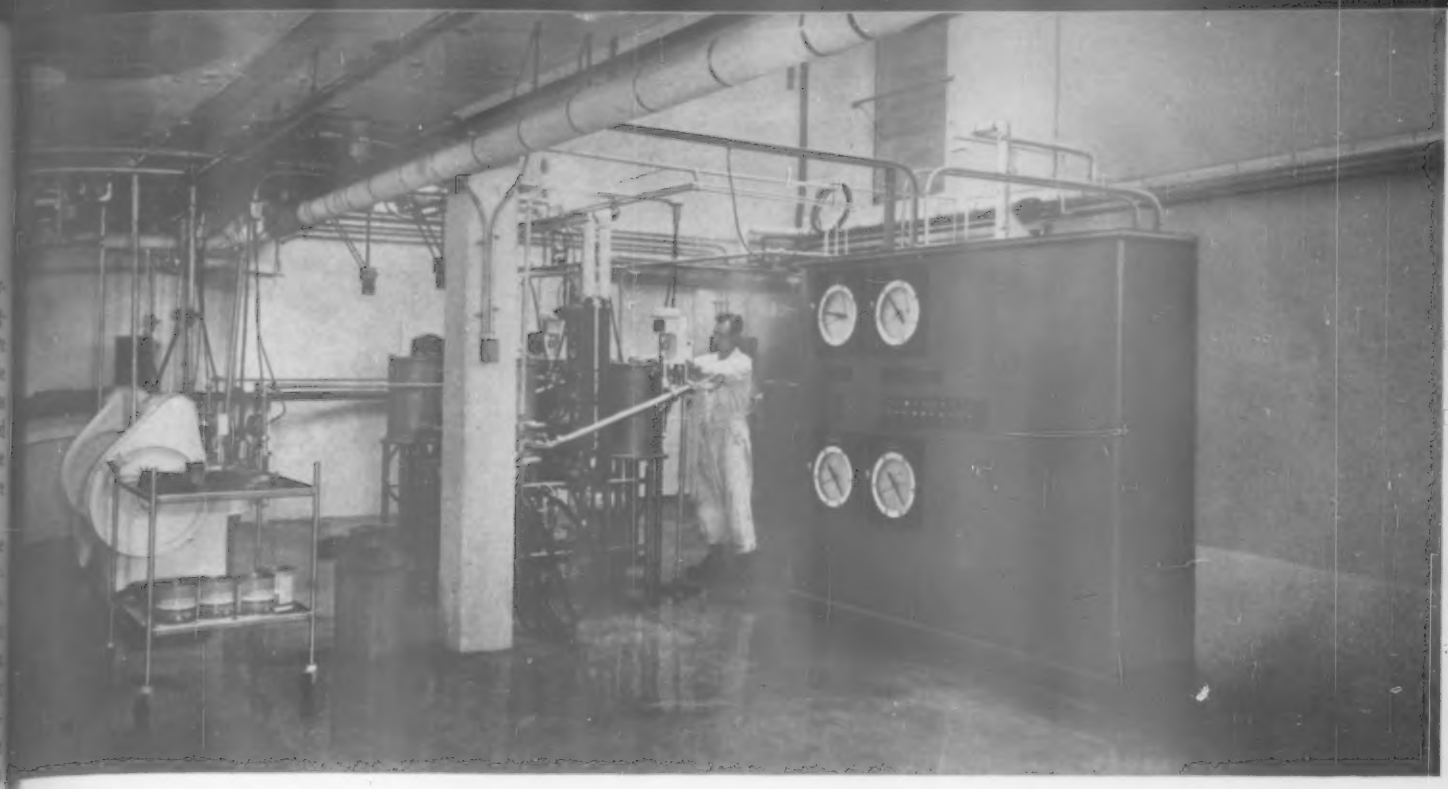
A procedure for the stepwise degradation of the lower, straight-chain, satd.. fatty acids has been developed which utilizes the Schmidt reaction for decarboxylation of the acid, followed by permanganate oxidation of the resulting amine. The adaption of this method to the assay of isotopic concn. of individual carbon positions of propionic and acetic acids on a semi-micro scale is described. Radioactivity measurements on the degradation products of known C^{14}-labeled compds. have shown a very low cross-contamination between individual carbon positions.

Degradation of isotopically labeled citric, α-ketoglutaric and glumatic acids.

MOSBACH, E. H., PHARES, E. F., AND CARSON, S. F. *Arch. Biochem. Biophysics, 33,* 179 (1951).

(Continued on page 26 following technical papers)

[a] These Selected Abstracts are made available to FOOD TECHNOLOGY through the cooperation of Associate Editor H. A. Campbell and the General Foods Corporation of New York, N. Y. The abbreviations found in these abstracts are similar to those used by Chemical Abstracts.



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Abstracts

(Continued from page 20 preceding technical papers)

A new stepwise degradation procedure for citric, α-keotglutaric, and glutamic acids has been described. The method permits the detn. of the isotope concn. of each individual position of the carbon chain of these acids. The formation of symmetrical intermediates has been avoided through the conversion of glutamic acid to butyric acid via succinic acid semialdehyde. The validity of the method has been established with α-ketoglutaric acid-1, 2-C^{14} and a biosynthetic sample of labeled citric acid.

NUTRITION

Depletion of carbohydrate reserves by starvation and exercise.

Rose, D., and Peterson, R. *Canadian J. Technol., 20,* 421 (1951).

Expts. with rats showed that reserve carbohydrate in both muscle and liver was somewhat depleted by starvation and was seriously depleted by exercise. A combination of these two caused max. depletion. Negligible recovery of these reserves occurred in 24 hr. when starvation was continued, but recovery was complete within six hours when sugar was fed and after 12 hr. the level exceeded that found in untreated control animals. Expts. with hogs indicated that recovery of muscle carbohydrate reserves occurred in about eight hours following feeding of a high sugar food. Feeding of oat chop alone, or chop and molasses, was less efficacious than feeding chops and sugar. These expts. indicate that current methods of handling hogs at the slaughter house result in low glycogen reserves and the meat produced will therefore have an undesirably high pH. Feeding of a mixt. of sugar and chop immediately upon receipt of the animal at the plant would alleviate this condition.

The influence of a high-sucrose diet on the calcium and phosphorus percentage of the rat femur, and a comparison with its effect on the enamel and dentine of the rat incisor teeth.

Hartles, R. L. *Biochem. J., 49,* 574 (1951).

The calcium and phosphorus content and the calcium/phosphorus ratios in the rate femur were the same whether the animals were raised on a stock diet of Lever cubes or a diet contg. 67% sucrose. This is in contrast to the effect on the enamel and dentine of the incisor teeth of the same rats (Hartles, 1951), and makes it clear that the "sugar" disturbance is confined to the teeth and does not include bone. The correlation between the amts. of calcium and phosphorus in enamel, dentine and bone has been evaluated. The findings support the view that the processes of mineralization in the three tissues are significantly different.

The comparative nutritive value of mono-, di-, and triglycerides.

Mattson, F. H., Baur, F. J., and Beck, L. W. *J. Am. Oil Chemists Soc., 28,* 386 (1951).

Mono-, di-, and triglycerides of corresponding fatty acid compn. were of equiv. caloric efficiency. The caloric efficiencies of the mono-, and triglycerides of pure lauric or stearic acid were found to be low. This may have been due wholly or partially to poor absorption. Autopsies and histological examn. of the tissues of the animals revealed no abnormalities attributable to the consumption of any of these fats. Appearance of all animals was normal throughout the expt. The body fat of the animals was the same regardless of the type of glyceride structure fed. However the type of body fat deposited reflected, in part, the fatty acid component of the dietary glyceride.

More protein found in pasteurized fresh milk.

Cook, B. B. *Science News Letter, 60,* 242 (1951).

Slightly greater wt. gains were made by rats fed fresh milk than by those fed evapd. or dried skim milk in a 16-month test at the University of California College of Agriculture. This indicated a slight superiority of the fresh milk protein over that found in the other two forms.

The effect of feeding thyroprotein to dairy cows during the decline of lactation in successive lactations.

Swanson, E. W. *J. Dairy Sci., 34,* 1014 (1951).

Cows were fed 15 g. of thyroprotein daily during the declining phase of two successive lactations. Thyroprotein produced an increase in milk yield and heart rate. No harmful effect could be attributed to this moderate thyroprotein feeding either because of stimulation or depression.

The effect of aureomycin and vitamins on the growth rate of chicks.

Biely, J., and March, B. *Science, 114,* 330 (1951).

Dietary levels of nicotinic acid, folic acid, or riboflavin that are suboptimal for max. growth rate of the chick under normal conditions may be adequate when aureomycin is fed. It is quite probable that the effect of aureomycin, in lowering the dietary requirements for certain vitamins, is brought about through a reduction in the numbers of intestinal microflora which might compete with the host for members of the vitamin B complex and/or by permitting the proliferation of microorganisms which synthesize these vitamins. The feeding of aureomycin would thus make available to the chick a larger proportion of the vitamins supplied by the diet and/or increase the amts. of vitamins available as a result of favorable microbiosynthesis.

Obesity. I. As related to health and disease.

Woods, R. *Borden's Rev., 12,* 83 (1951).

The importance of overweight as a primary factor in increasing morbidity and mortality is recognized from both clinical and life insurance studies. It is recognized that abdominal girth or flabbiness, both measures of body fat or obesity, have an influence in increasing mortality over and above the excess mortality assocd. with overweight itself. The significance of body fat content, as distinguished from overweight *per se,* in influencing the incidence of disease and death requires further study. No insurance data exist which differentiate between the mortality risks incurred by overweight due to increased muscle mass or by overweight due to accumulation of excess fatty tissue. It has been recognized that overweight must be further defined. The development of methods for a more quant. measure of obesity by means of estn. of body fat, makes it possible to distinguish various types of overweight.

ENGINEERING

Symposium on liquid-liquid extraction. I. Flooding rates in packed columns.

Dell, F. R., and Pratt, H. R. C.

II. Hold-up and pressure drop in packed columns.

Gayler, R., and Pratt, H. R. C.

III. Droplet behaviour in packed columns.

Lewis, J. B., Jones, I., and Pratt, H. R. C. *Instn. Chem. Engrs. Lond.,* 1-21, 22-38, 39-59 (1951); *Brit. Abstracts, BI,* 552 (1951).

An improved method is given for the detn. of flooding rates in packed liquid extn. columns. Data for 3-in. and 6-in. columns have been obtained using ten liquid-liquid systems and nine packings. The results are correlated in terms of the phase velocities and the phys. properties of the components. It is shown that dispersion of the solvent within the packing eliminates the necessity to expand the column by more than 30-40% at the solvent entry. II. Data are reported for a 3-in. column using five solvent-water systems and six packings. The hold-up is shown to be linear with velocity of the discontinuous phase until a value of 15% (on the free space) is reached; thereafter it increases rapidly to a value between 30 and 50% which depends on the system employed and the velocity of the continuous phase. III. A photographic method of measuring droplet sizes as they enter and leave a packed column is described and results for nine liquid-liquid systems and six packings are reported. Provided the entering droplet and the packing are above certain critical sizes, a correlation can be used which relates the mean vol. surface diameter to the phys. properties of the system. Discontinuous phase η and d and packing size (above the critical) are shown to have no influence. The size distribution of the droplets was found to be non-Gaussian.

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Abstracts

FOOD TECHNOLOGY

Rancidity of butter fat. II. Use of L-ascorbyl esters as antioxidants. III. Use of ethyl gallate in combination with other antioxidants. IV. Factors influencing rancidity.

MUKHERJEE, S., RAY, S., AND GOSWAMI, M. *J. Indian Chem. Soc., 27*, 539-44, 545-47, 557-62 (1950); *Brit. Abstracts, BIII*, 309 (1951).

II. A method for prepg. the L-ascorbyl esters of stearic, palmitic, myristic, and lauric acids (50-60%) is described. On storage of butter fat at 37°, 0.01% of each of these esters, dissolved in the fat, afforded marked protection against oxidation (Swift stability test), and more than doubled the induction period (time to reach peroxide val. 10) at 100°. The antiscorbutic action of the esters is equiv. to that of ascorbic acid. L-ascorbyl laurate and palmitate (0.02 or 0.05%) in butter fat are only partly destroyed during the induction period on accelerated oxidation (bubbling with air) at 37°. III. On storage of butter fat at 37°, marked antioxidant activity was observed when H_2 had been passed through the fat for 2 hr. at 50°, or when Et gallate (I) along (0.005%) or together with ascorbyl palmitate (II) (0.01%) were dissolved in the fat with or without preliminary treatment with H_2. Storage trials in 5 lb. tins indicated comm. possibilities for these methods; the peroxide val. of the fat after 5 months were: H_2 treatment alone 1.8, H_2 treatment with I or with I and II 1.0. In accelerated oxidation trials at 38.5° carotene and vitamin A in butter fat were protected by I (0.005%) by II (0.01%) and (especially) by II together with α-tocopherol (0.005%). IV. Expts. in which sterilized butter fat was stored at 37° under different conditions as regards the presence or absence of air, light, and moisture, and examd. after 15-85 days, by detg. the peroxide, Kreis, and acid val. are described; the effects of any one, any two, or all three of the above factors are compared. The action of atm. O_2 is essential and sufficient alone to cause rancidity, light and moisture (relative efficiency undetd. having only a catalytic effect; moisture hydrolyses the glycerides, but rancidity may occur by oxidation alone; microorganisms are not primary agents, but form subsidiary decomp. products (increased hydrolysis and formation of ketones).

Rancidity of butter fat. VI. Action of light.

MUKHERJEE, S. *J. Indian Chem. Soc., 27*, 589-98 (1950); *Brit. Abstracts, BIII*, 390 (1951).

Peroxide val. confirm that O_2 is essential for the initiation of rancidity of butter fat. The rate of development of rancidity in the presence of O_2 and light from a W filament or ultra-violet lamp or X-rays is proportional to the intensity of the exciting source. In the absence of O_2, X-rays and ultra-violet light do not produce off-flavor. The effect of ultra-violet radiation on the oxidation of fatty acids is described.

Rancidity of butter fat. VII. Influence of water and humidity on rancidity.

MUKHERJEE, S. *J. Indian Chem. Soc., 27*, 6 (1950); *Brit. Abstracts, BIII*, 310 (1951).

Increasing atm. humidity enhances the rate of hydrolytic rancidity of fats, but retards the oxidative rancidity as measured by peroxide formation. It is concluded that water slightly retards the absorption of O_2 by pure fats.

Rancidity of butter fat. VIII. Chemical accelerators of rancidity. Effect of peroxides and volatile products of oxidation of fat on rancidity.

MUKHERJEE, S. *J. Indian Chem. Soc., 27*, 613 (1950); *Brit. Abstracts, BIII*, 310 (1951).

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DIAMOND CRYSTAL

Antioxidant SALT

Abstracts

A very small quantity of rancid fat greatly reduces the rancidity induction period of fresh fats, while the volatile oxidation products have no effect. Hence peroxides are responsible for the oxidising effect of the oxidised fats.

Results of some tests with frozen oysters.

POTTINGER, S. R. *Comm. Fisheries Rev., 13,* 1-5, October, 1951.

The following suggestions are offered in the freezing of oysters: Freeze only strictly fresh, high-quality oysters. Oysters of poor quality deteriorate very rapidly in frozen storage. Subject oysters to a min. of washing and blowing in fresh water (0.75% salt water is better) during the cleaning process. This reduces the quantity of free liquor which forms when the oysters are thawed. Drain oysters thoroughly prior to packaging. Use a watertight, moisture-vaporproof, attractively designed package, preferably of the rectangular type. When filling and closing the package, leave only enough headspace to allow for expansion of the oysters during freezing. Excessive air space in the package will lead to localized "freezer-burn" and discoloration of the oysters. Seal tightly to prevent leakage of contents and loss of moisture-vapor. Freeze immediately at a low temp., about —20° F. or lower. Store at 0° F. or lower in order to obtain a reasonable storage life. Thorough cleanliness and strict sanitary measures must be adopted in all phases of the plant operation for the production of a quality product.

Imitation jumbo shrimp made from small species, fragments.

Frosted Food Field, 13, 16, August, 1951; *Comm. Fisheries Abstracts,* 4, 17, October, 1951.

The small and broken shrimp are picked and shelled while fresh and placed in a mold or die. A pressure of about 10 pounds is then applied at a temp. of 210 degrees F. Under this pressure and temp., the jelly-like constituents of the meat solidify to form a surface skin that has the appearance in color of cooked shrimp. By longer heating, a product which actually is cooked can be obtained. The molded shrimp meat can be frozen and will not "bleed" after thawing.

Crab meat picking machine revealed.

Pacific Fisherman, 49, 63, July, 1951; *Comm. Fisheries Abstracts,* 4, 13, October, 1951.

A San Francisco company has recently patented a machine to ext. the meat from the bodies of any species of crab. According to the inventors, the machine has practically unlimited capacity, and only one person is needed to feed it. The extractor consists of a steel frame on which is mounted a stainless steel and aluminum wheel, driven by an elec. motor and reduction gear. The meat is removed from the body cavities by vibration and concussion caused when the bodies are shaken against a series of stainless steel springs which are set in a horizontal position on the wheel. An adjustable secondary wheel is set against the revolving springs. The bodies are displaced by the action, and the meat is released from the cavities into receiving pans. The machine removes about 80% of the shell and the balance is removed by hand as the meat is passed through the rays of an ultra-violet lamp. The latter causes pieces of shell or bone to fluoresce so that they may be easily distinguished.

Fish meal and fish solubles in poultry feeding.

CRAVENS, W. W. *Fish Meal and Oil Ind., 3* (1951); *World Fisheries Abstracts, 2,* 35-6, September-October, 1951.

Includes tables of (1) essential amino acid compn. of fish meal, soybean oil meal, and corn gluten meal, and (2) the vitamin values for fish solubles and fish meal.

New, quick, cold-water dessert mix.

SHEPHERD, A. D., MCCREADY, R. M., AND OWENS, H. S. *Food Eng., 23,* 44 (1951).

New dessert, made with low-methoxyl pectin, is prepd. in 2 min. without heating.

Radiation in food preservation.

Refri. Res. Found., Infor. Bull., 7, September 14, 1951.

The cathode rays (free ionizing electrons) seem to offer the most promise, raw milk dosed with mixed fission products from

SOME FOOD FOR THOUGHT

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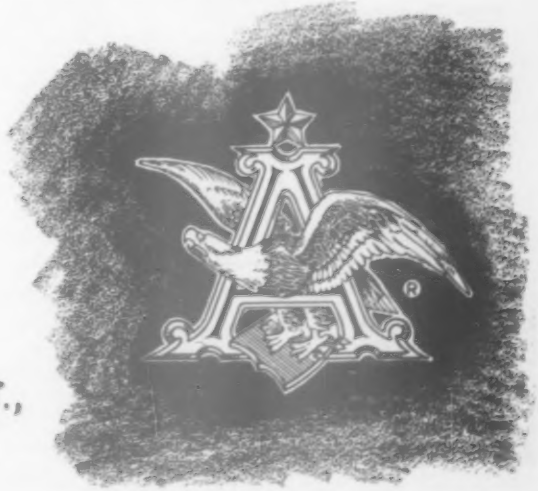

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Frozen Fruit Juices
Fruit Fillings (Pie)
Fruit Juices
Fruit Syrups
Glazes
Ice Cream
Marshmallow Toppings
Meringues
Milk Puddings
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*SeaKem is the trademark for the standardized, water-soluble, sea plant extractives manufactured by the SEAPLANT Chemical Corporation. Refined by rigidly controlled processes which insure dependable uniformity and purity, SeaKem "Colloids Out of the Sea" are light amber to colorless, free-flowing flaky powders. Odor and flavor are extremely slight or entirely absent. Available in a variety of types suitable for use in an unusually wide range of applications, SeaKem Products have won acceptance on the basis of proven advantages with many of this country's leading food manufacturers and processors.

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Abstracts

nuclear reactors has kept a month under ordinary refrigeration. These radiations do not destroy vitamins or amino acids, while they do sterilize and destroy enzymes, but they also start some unusual reactions.

Ionizing radiation.

Atomic Energy, N. L., 6, 4, October 9, 1951.

In the course of attempting to find practical industrial uses for gross fission products, the University of Michigan's Engineering Research Institute has irradiated foodstuffs to det. the bacteria killing ability of ionizing radiation. Source of the ionizing radiation used in the expt. was radio-cobalt (cobalt-60) which had been prepd. in the Brookhaven National Laboratory nuclear reactor. Samples of homogenized pasteurized milk were exposed to the radioactive source for periods of twenty-four and forty hours. After three weeks of storage at 77° F., (then, sealed in plastic bags to prevent contamination by normal atmospheric bacteria) the samples showed no change in appearance, with the exception of a slightly creamier color. Non-irradiated milk, also kept in plastic bags, soured within twenty-four hours. Bacteriological analysis showed that the high bacteria count of the milk, prior to irradiation, was reduced to zero after the samples had been subjected to rays from cobalt-60. Samples of beefsteak, exposed to the gamma rays from the radiocobalt, were free from putrid odor or surface changes three weeks after irradiation, but non-irradiated meat samples began to decay rapidly after 48 hours at the 77° F. temp. Still to be detd., is whether the irradiation affects flavor or nutritional values.

Ionizing radiation.

Atomic Energy N. L., 6, 4, October 9, 1951.

A suggestion that blood plasma might be more efficiently sterilized with high energy electrons, than the presently used ultraviolet radiation, was recently made by Dr. Ernest E. Charlton, before a medical group. However, lab. work is necessary before it can be detd. whether or not cathode ray treatment of blood plasma causes any undesirable effects. Using a modified million volt X-ray machine, operating at about 900,000 volts, meat, fresh beans, grains, blueberries, strawberries, peaches, raisins, bread and honey have been sterilized at the G-E lab. It was explained that wrapped bread, which was exposed to the cathode rays, has been kept for many months at room temp. without becoming moldy and has retained a fresh bread odor.

PACKAGING

Tin can substitute.

Packaging Parade, 19, 13, October, 1951.

Disclosure has been made of the development of a container resembling an ordinary "tin" can but fabricated from 3 ply aluminum foil and impregnated with plastic. As a substitute for conventional cans, this container is expected to bring about a reduction in price. Shortages in container supply in an emergency will be alleviated. Container is said to be suitable for all types of food products.

PHYSICAL RESEARCH

Structural and chemical studies on collagen.

SCHMITT, F. O. *J. Am. Leather Chemists Assoc.*, 46, 538 (1951).

A summary of the X-ray diffraction and electron-microscopy of collagen and their significance in the tanning and leather industry.

Specific heat of foodstuffs. Part I: An experimental determination.

SHORT, B. E.

Part II: A mathematical and thermodynamic determination.

BARTLETT, L. H. *Bureau of Engineering Research*, January, 1943; *Bibl. Tech. Reports.*, 16, 116 (1951).

Instrumentation for isotope utilization.

KURANZ, J. L. *Ind. Labs.*, 2, 41, October, 1951.

Scintillation proportional and Geiger counters, and ionization chambers are discussed in relation to the types of radiating particles which they are best suited to measure.

PATENTS (U. S. A.)

Isolation of bacterial mutants.

DAVIS, B. D. 2,571,115, October 16, 1951.

The method of isolating nutritionally deficient bacterial mutants from a parent stock which comprises cultivating a mutant and non-mutant contg. all of the nutritional substances necessary to support the mutant and non-mutant strains, eliminating from the medium the mutant strain growth supporting nutritional substance thereby preventing the growth of mutant strains, sterilizing the growing non-mutant strain with penicillin which will sterilize growing bacteria but which will not sterilize the resting mutant strain, eliminating the penicillin, and cultivating the thus treated population in an enriched medium capable of supporting the mutant strain.

Blending of dry powdered materials.

URBAN, V. 2,570,168, October 2, 1951.

App. for the blending of finely subdivided dry material comprising a bin of any capacity, generally quadrangular plan form and substantially const. cross-section between its ends, means for feeding the material into bin in uniform superimposed layers, a screen of stiff construction extending into and across bin between its ends, of a form such as to divide the bin into two, lengthwise, in a plane at an angle to the horizontal of the same order as the angle of repose of the material, means for traversing screen forwardly inclined in the bin in a lengthwise direction thereof, means for imparting oscillatory movement to the screen substantially in its own plane contemporaneously with the traversing thereof, bin comprising from end to end thereof, downwardly convergent basal surfaces leading into at least one slot-like discharge opening, and a conveyor device extending along and below such discharge opening for the reception and disposal of materials gravitating into the same from the bin interior.

Preparation of fine powders from gel materials.

DEANESLY, R. M. Assignor to Universal Oil Products Company. 2,572,321, October 23, 1951.

A method for prepg. a finely divided powder from a gel having vaporizable and solid components, which comprises, passing gel in a fluid like stream to a heating zone maintained at a superatmospheric pressure that is above the crit. pressure of the vaporizable component of gel, heating the mixt. to a temp. of the order of the crit. temp. of vaporizable component and passing the thusly heated gel at superatmospheric pressure through a restricted outlet to a reduced pressure zone, maintaining the latter at a sufficiently low pressure with respect to heated and high pressure zone to provide substantially instantaneously and adiabatically an increased volume of stream that is at least twenty times that in the first zone and effecting thereby a powdering of the solid component of gel, into particles largely less than two microns in size, withdrawing the resulting powder and vapors through particle sepg. means and recovering powder therefrom.

Schwarz

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Write to nearest regional secretary, if within an area covered by a regional section, or to the Executive Secretary of the Institute, for an application form and information regarding qualifications and classifications.

Abstracts

Food product.

CLOUGH, P. J. et al. Assignors to National Research Corporation. 2,573,406, October 30, 1951.

A process for producing a sol. coffee which comprises extg. sol. coffee solids from roasted, freshly ground coffee by passing through coffee water which has a temp. not much greater than 100° F., stopping water extn. when about 18-20% by wt. of the coffee has been extd. as sol. coffee solids; treating a portion of the extd. coffee grounds to remove addnl. sol. coffee solids by hydrolyzing grounds to create an essentially tasteless hydrolysis product; hydrolysis step comprising the steps of preparing an aq. suspension of extd. grounds and an absorptive colloid, acidifying suspension by adding sulfuric acid to give a sulfuric acid concn. of about 1% by wt. of the aq. suspension, cooking acid suspension for approx. 1 hour at about 212° F., raising the pH of cooked suspension to approx. 5-6 by adding a basic compd. which forms a relatively insol. sulfate, cooling suspension, centrifuging cooled suspension to sep. the majority of the soln. from the suspended solids and filtering resultant soln. to provide a substantially tasteless soln. contg. substantially no undissolved solids and having less than 10% dissolved solids; concg. at least as high as that of water ext.; adding concd. tasteless soln. to ext. to give a mixt. having a ratio by wt. of approx. 4 to 1 of dissolved water ext. solids to dissolved tasteless solids; and drying mix to remove substantially all of the water therefrom.

Process for the preparation of full flavored fruit concentrates.

HOMILLER, R. P., AND EISENHARDT, N. H. Assignors to the U. S. A., 2,572,846, October 30, 1951.

The process comprising stripping a nonpomaceous fruit juice of volatile flavor constituents by subjecting the juice to partial vaporization by heating at atm. pressure; sepg. the vaporized portion contg. a major proportion of the volatile flavors from the unvaporized portion of the juice; passing the vapors through a fractionating column; condensing the volatile flavor vapors by cooling; recycling part of this cooled condensate to the fractionating column to condense the water vapors therein; removing another part of condensed volatile flavors, which part forms a first essence; depectinizing the unvaporized portion of the juice, which is stripped juice, concentrating the depectinized juice by evapn. under reduced pressure to form a juice concentrate condensing the resultant vapors to form a liquid distillate; heating the distillate to vaporize part of it; sepg. the vaporized portion and forming a second liquid essence therefrom by fractionation, condensation, and recycling of condensate to the fractionation as aforesaid; and combining the first essence, second essence, and the juice concentrate to form a juice concentrate of fuller flavor.

BOOKLET ON VANILLA AVAILABLE

A booklet describing the history, growing, processing and extracting of vanilla has been published by the Vanilla Bean Association under the title "The Story of Pure Vanilla," by Bernard L. Lewis. This illustrated bulletin will be of interest to all users of vanilla and will provide a better understanding of some of the problems involved in the production and utilization of vanilla and vanilla products. It may be obtained free of charge upon request addressed to the Vanilla Bean Association of America, Inc., Hotel Gramercy, 2 Lexington Avenue, New York 10, N. Y.

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INDIA'S FOOD SITUATION

India's Food and Agriculture Minister has recently announced that the country's food crisis during the past eight months has been finally overcome. This follows the Indian Government's mid-June authorization to all states to restore the food ration from 9 ounces to 12 ounces per day as soon as possible.

The deterioration of India's food situation, after hopes of early achievement of self-sufficiency, began in mid-1950 and steadily worsened as the country suffered a succession of earthquakes, floods, cyclones and droughts. Particularly affected was Bihar which had previously experienced successive crop failures. Altogether, some 5.5 to 6 million tons, or about one eighth of India's total annual food grain consumption of around 46 million tons, was estimated to be lost or destroyed. The following figures show why India's food program had to be revised upwards for 1951:

Available Supplies of Foodgrains

Year	Domestic production	Imports
	(million tons)	
1948	43.7	2.8
1949	42.8	3.7
1950	43.3	2.2
1951 (estimate)	38.3	5.5 to 6.0

To meet the crisis, the Government had to reduce its own stocks, which stood at 1.58 million tons at the beginning of 1950, to 0.75 million at the end of the year, and to cut the daily ration from 12 ounces to 9 ounces from January 1951. Requirements for the rationed population, which by the beginning of the year had increased to 125 million people, were estimated at 10 million tons. Three and a half million tons were to be procured from surplus-producing Indian States and the remainder from abroad. Of the internal procurement program 1.87 million tons had been obtained by the middle of May, while by the end of May, 1.65 million tons had been received from abroad out of a total of 4.4 million tons contracted for 1951 from the countries shown below (units are of thousand metric tons): United States, 1,700; Argentina, 573; Thailand, 343; Burma, 343; U.S.S.R., 100; Pakistan 258; Canada, 296; Australia, 240; Uruguay, 30; China, 520.

The above figures do not include the balance of the Russian offer of 400,000 tons, nor an additional 2 million tons approved by the United States Congress. As a result of internal procurements made and imports already received, Government stocks by the end of June 1951 rose once again to 1.6 million tons, or about 2 months' requirements for the rationed population. But stocks in individual States have by no means improved uniformly and a majority of them have thus far been unable to restore the 12 oz. daily ration. However, the Government proposes increased allotments to major deficient States. This, together with the heavy program of imports for the rest of the year, should enable the ration to be fully restored in all regions. The immediate problem of the lack of purchasing power in areas of scarcity remains difficult. For example, in Bihar, financial assistance and the setting up of an increasing number of "fair price" shops may not be enough to cope with

widespread distress, without organized large-scale free distribution of food from relief kitchens. This year's crisis has created an intensified state of malnutrition in many parts of India and has once again brought to the fore the country's longterm problems of supply and distribution. [*FAO Food and Agricultural Statistics*, **4**, No. 7-8, p. 27 (1951).]

DISCUSSION OF TUNNEL-AND-TRUCK DEHYDRATORS PUBLISHED

The Western Regional Research Laboratory has completed the revision of the section entitled "Tunnel-and-Truck Dehydrators" from U. S. Department of Agriculture Misc. Publ. No. 540 (1944), long out of print. The discussion has been published in the form of a bulletin (AIC-308) and deals with counterflow tunnels, parallel flow tunnels, two-stage tunnels, combination compartments and tunnels, and other tunnel arrangements. The 30-page publication of which W. B. Van Arsdel is the author, is well illustrated with many graphs, drawings, flowsheets and tables of technical data. It is available upon request from the Western Regional Research Laboratory, Albany 6, California.

Advertisers' Index

	PAGE
Anheuser-Busch, Inc.	31
Aseptic-Thermo Indicator Co.	28
Brewers Yeast Council	36
Continental Can Co.	14-15
Corning Glass Works	19
Distillation Products Industries	1
Dodge & Olcott, Inc.	4
Felton Chemical Corp.	21
Florasynth Laboratories, Inc.	33
Food Machinery & Chemical Corp.	17
Food Research Laboratories, Inc.	38
Fritzsche Bros., Inc.	38
General Foods Corp. (Diamond Crystal Salt)	30
Griffith Laboratories, Inc.	13
Hoffman-LaRoche, Inc.	22
Huron Milling Co.	35
International Minerals & Chemical Corp.	7
Johns-Manville	18
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LaWall & Harrisson	35
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Merck & Co., Inc.	9
Minneapolis-Honeywell Regulator Co.	24-25
Norda Essential Oil & Chemical Co., Inc.	8
Orkin Institute	27
The Pfaudler Co.	2nd cover
Chas. Pfizer & Co., Inc.	23
Rohm & Haas Co., Inc.	4th cover
Schwarz Laboratories, Inc.	33
Seaplant Chemical Corp.	32
Foster D. Snell, Inc.	38
Sterwin Chemicals, Inc.	5
U. S. Stoneware Co.	3rd cover
van Ameringen-Haebler, Inc.	29
Vegetable Juices, Inc.	36
Wallace & Tiernan Co., Inc.	37

TECHNOLOGICAL STUDIES OF THE STARFISH

The common five-rayed starfish (*Asterias forbesi*) is responsible for the destruction of a large quantity of oysters every year. It is estimated that oystermen in the Long Island Sound spend over a million dollars per year for control efforts and seed and market oysters killed by this menace. Besides the methods of control, there has been an effort made in recent years to find some utilization of starfish, especially during their recurring periods of abundance. The composition of starfish, and the value of starfish meal and fertilizer is considered in the new leaflet *Technological Studies of the Starfish*.

This 47-page illustrative pamphlet also considers experiments with thiaminase, a thiamine-destructive enzyme found in starfish. The presence of this enzyme tended to retard the growth of chickens experimentally fed with meal of a high starfish concentration. Evidence indicates that thiaminase would be destroyed at temperatures commonly used in fish-meal dryers.

The commercial utility of starfish is limited because of the inconsistency of supply and the expensive cost of reduction since there are no oils or other byproducts to help defray the cost of production. The low nitrogen content coupled with the high ash content make starfish meal uneconomical. [From Fishery Leaflet 391, Division of Information, U. S. Fish and Wildlife Service, Washington 25, D. C.]

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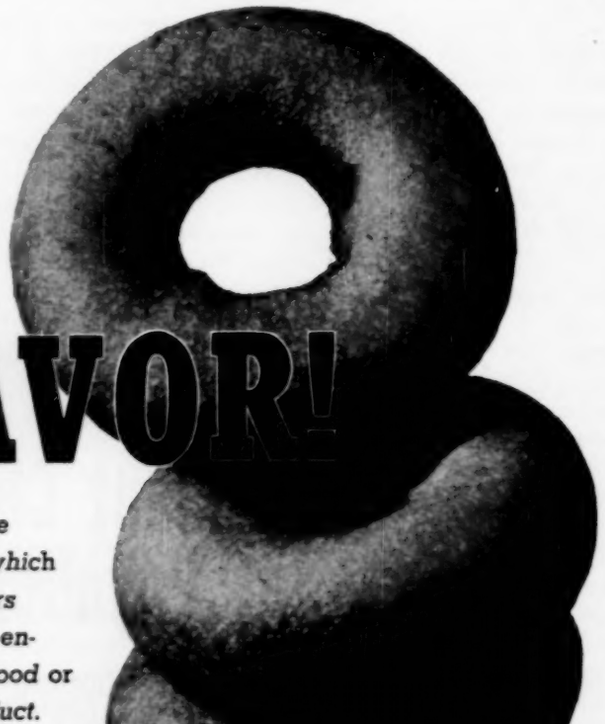

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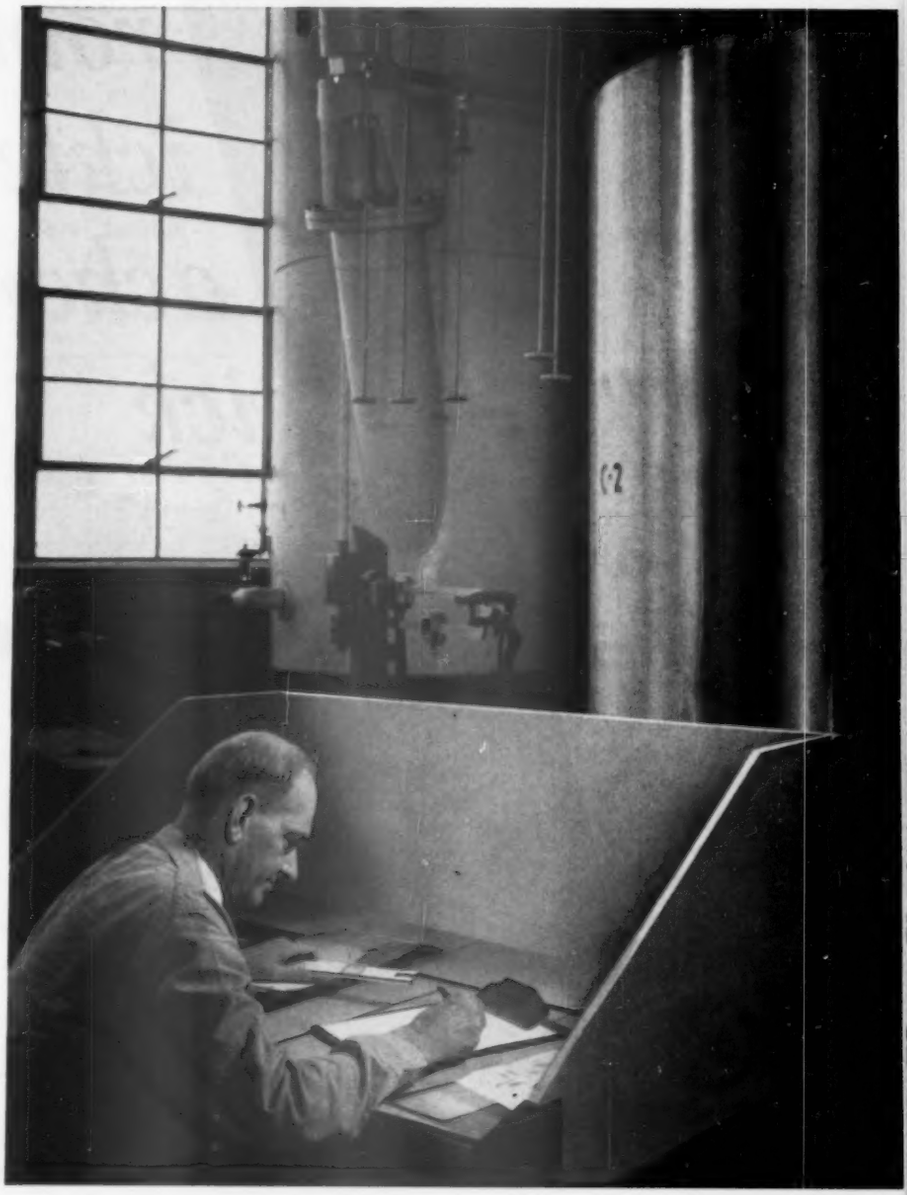

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CONTENTS

RENDERING LARD AT LOW TEMPERATURES. C. E. Swift and O. G. Hankins 161

MICROBIOLOGY OF FROZEN ORANGE CONCENTRATE. II. FACTORS INFLUENCING THE SURVIVAL OF MICROORGANISMS IN FROZEN ORANGE CONCENTRATE. Saul S. Hahn and M. D. Appleman 165

MICROBIOLOGY OF FROZEN ORANGE CONCENTRATE. III. STUDIES OF ENTEROCOCCI IN FROZEN CONCENTRATED ORANGE JUICE. Milton T. Kaplan and Milo D. Appleman 167

STRUCTURAL CHANGES OCCURRING IN MUSCLE TISSUE DURING REPEATED FREEZING AND THAWING. James B. Nichols and David L. Mackintosh 170

SOME IMPLICATIONS OF RECENT THEORETICAL WORK ON CANNING PROCESSES. E. W. Hicks 175

DEVELOPMENT OF OFF-FLAVOR IN SHELLED PEAS HELD IN COLD WATER. Rachel U. Makower, Mildred M. Boggs, and Horace K. Burr 179

EVALUATION OF PLATING MEDIA FOR CITRUS CONCENTRATES. D. I. Murdock, J. F. Folinazzo, and V. S. Troy 181

THE MECHANICS AND INTERPRETATION OF HEAT PENETRATION TESTS IN CANNED FOODS. D. V. Alstrand and O. F. Ecklund 185

COLOR MEASUREMENT AS A QUALITY CONTROL TOOL. Clifton C. Sutton, Roberta Connors Ambler, and David Arkin . . 190

ASCORBIC ACID AND MEAT COLOR. Betty M. Watts and Barbara T. Lehmann 194

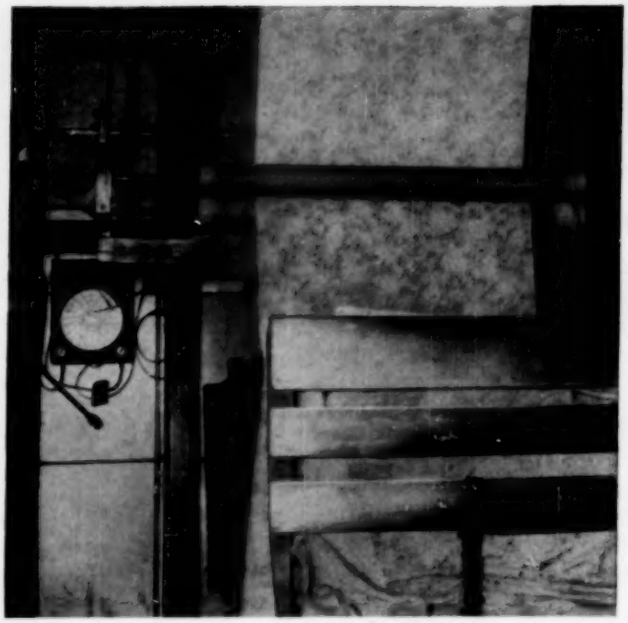
BOOK REVIEW 196

REGIONAL SECTION NEWS *10*

SELECTED ABSTRACTS *20*

Authors of papers intended for publication in FOOD TECHNOLOGY should request from the editorial office a copy of the booklet, entitled "Information and suggestions to authors." Manuscripts submitted for publication in FOOD TECHNOLOGY should follow the style described in this booklet.

The Institute of Food Technologists assumes no responsibility for statements in contributed articles appearing in FOOD TECHNOLOGY. Editorials present only opinions of the writers and do not necessarily reflect policies of the Institute of Food Technologists.



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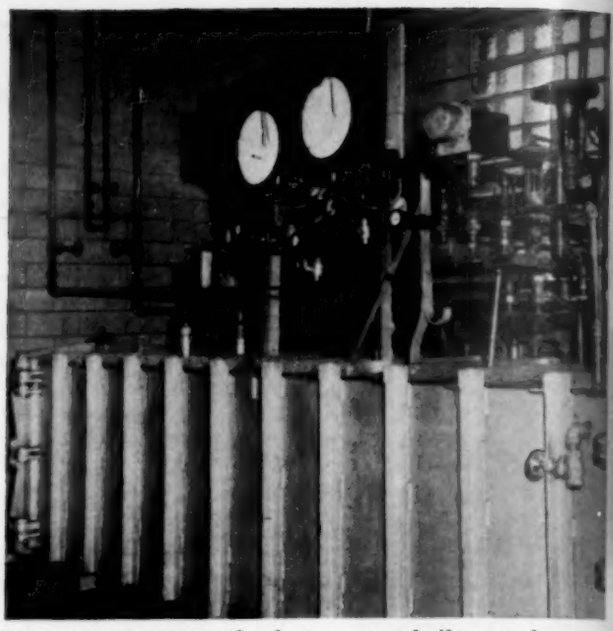

DUAL USE OF RETORT, *thanks to custom-built control system, permits using same equipment for boiling meats that is used for pressure-cooking glass-packed products. Cook time has been cut; glass breakage eliminated; labor saved; and production increased for both jobs.*

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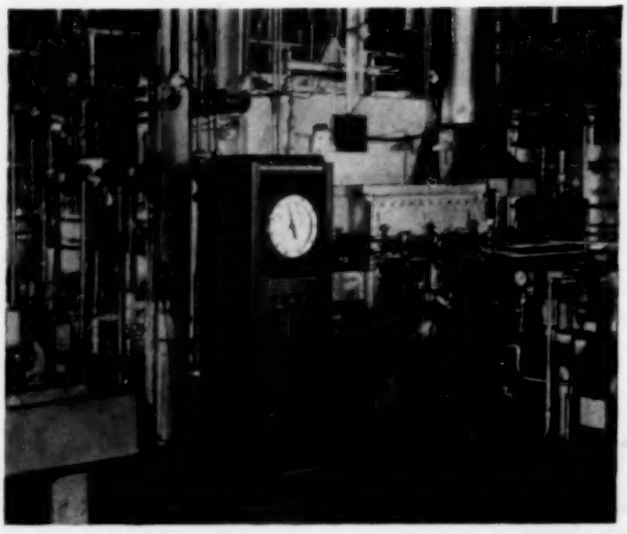
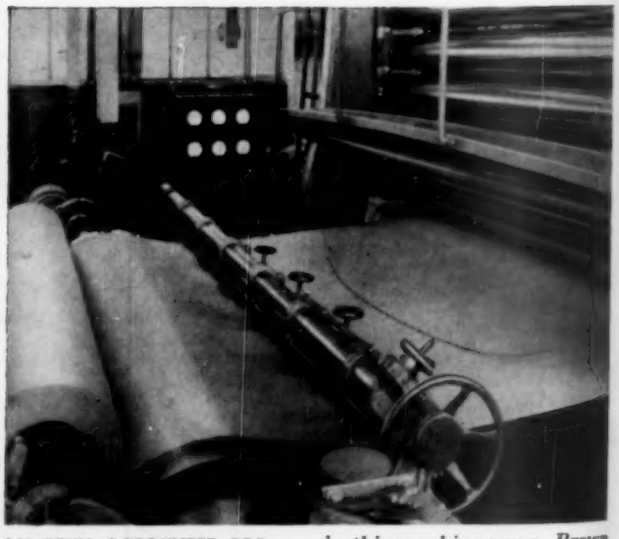
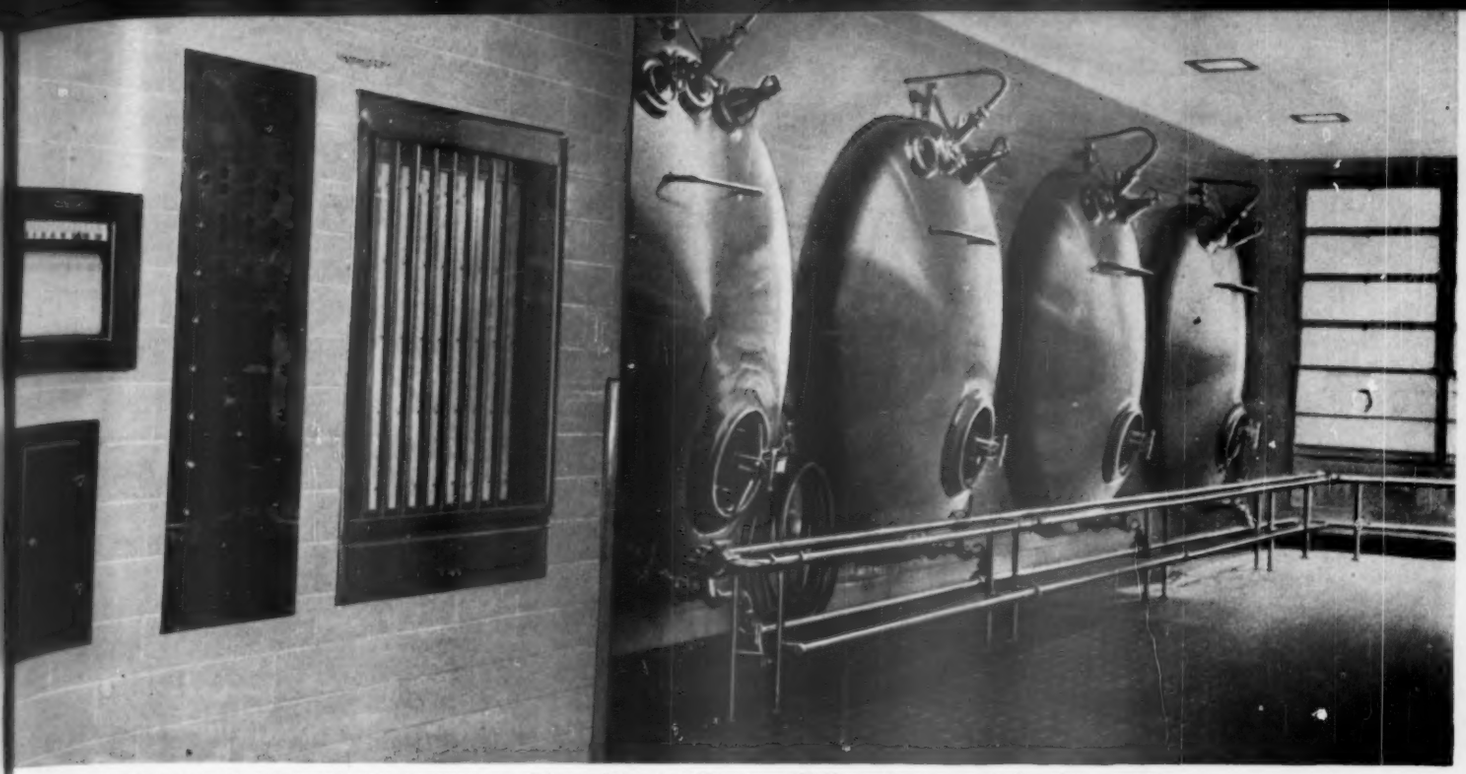


PREVENTING COSTLY ERRORS *in heat treatment is the job of this Brown dew point recorder. Carburizing, nitriding, dry cyaniding and carbon restoration are affected by the dew point of gases employed, and have a profound effect upon the final metallurgical results.*



ALL BTU'S ACCOUNTED FOR . . . *in this machine room. Brown integrating flow recorders keep close track of every pound of steam . . . give speedy indication of excessive steam consumption. A variety of instruments hold operating costs at a minimum throughout pulp and paper mills.*



STORAGE TEMPERATURES CENTRALIZED *on this multi-point ElectroniK Recorder are easy for the operator to check at any time in a big eastern dairy's milk storage room. Use of modern thermocouple instruments has brought a large saving in milk tank clean-up time—and has reduced maintenance and repair bills.*

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June 8-12

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"CHEMICALS IN FOODS" SECTION, AT THE IFT ANNUAL MEETING, ATTRACTING WIDE INTEREST

One of the most keenly discussed national issues at the Institute's Annual Meeting in June will be the subject "Chemicals in Foods." Nationally prominent food technologists representing both sides of the question will be presentting their story in the section "Chemicals in Foods" to the Institute membership. The scheduled time for this section is given elsewhere in this issue of Food Technology along with the entire program for the annual meeting at Grand Rapids, June 8th through 11th.

FOOD TECHNOLOGISTS WILL NEED RECREATION

As a respite from the 140-odd papers to be presented at the June Annual Meeting in Grand Rapids, food technologists will need some relaxation.

This is being very ably arranged by the Michigan group, with the following events being scheduled:

Sunday night: At the Pantlind Hotel there will be an informal get-together with refreshments, for those who are able to attend. Members of the press will be present to chat with the attending technologists on their fields of interest.

Monday night: The members of the National Institute will be guests of the Great Lakes Section (without charge). They are invited to witness "A Night in Holland," a two hour entertainment in the Grand Rapids Civic Auditorium put on by a group of Dutch entertainers from Holland (Michigan). It is not generally known that a very sizable colony of Dutch people have settled near Grand Rapids in the town of Holland, Michigan, naming the town after their home country and, characteristically enough, devoting the land around the town to the raising of tulips. Annually this group puts on a Tulip Festival inviting the nation to attend a week-long celebration which features Dutch dances, Dutch costumes, and of course, the tulip fields which are in full bloom at the time of the festival. The same group of people who participate in the Tulip Festival will put on the entertainment for members of the Institute.

Tuesday night: This is the night of the banquet, at 6:30 in the evening in the big Grand Rapids auditorium to be followed by dancing in the ballroom of the Pantlind Hotel with a full, nationally known orchestra.

Two plant trips have been arranged for and the announcement of others is planned prior to the meeting.

A trip to Gerber Products Company at Fremont, Michigan will give food technologists an opportunity to see a modern plant processing baby foods.

A trip to Battle Creek has also been arranged and it is anticipated that open-house will be available to members of the Institute at both of the nationally known breakfast food manufacturers in this city.

Ladies' entertainment has been amply provided for by the committee in charge of this function. There will be a luncheon at one of the lovely Country Clubs in Grand Rapids, a fashion show, and conducted tours of the world's finest furniture showrooms, as well as a museum of antique furniture and collections. As the plans develop, other activities for the wives of visiting Institute members will be provided in this lovely oak-shaded Michigan town.

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SAMUEL CATE PRESCOTT AWARD WON BY WESTERN STUDENT

Presentation of the first Samuel Cate Prescott Award to Damian Musco (center) of the University of California, by Dr. S. C. Prescott (left). On the right is Dr. W. V. Cruess, first recipient of the Nicholas Appert Award of the Institute.

As announced previously in this journal, the Northeast Section of IFT in 1951 established the Samuel Cate Prescott Award to be granted to the student member of the Institute presenting in competition the best written account of a research project in the field of food technology. The Award has been won for the year 1951 by Damian Musco, a graduate student of food technology at the University of California at Berkeley. This is the first year of competition for the Award.

The topic of Musco's paper was "Gas Permeability of Plastic Films," and his report dealt chiefly with recent published research in this field. During the past year he has also conducted on his own account research on the use of plastic containers of various sorts as packages for green olives.

On February 26 Dr. Prescott himself made the presentation of the Certificate and the accompanying $100.00 check from the Northeast Section of the IFT at a meeting of the students and staff of the Department of Food Technology.

As announced in the February issue of this journal, the 1952 competition is open to all food technology students who are members of the Institute of Food Technologists. Eligibility includes all student members of IFT in good standing or former student members who attained the Bachelor's degree no more than 12 months previously.

FORMATION OF AGRICULTURAL RESEARCH INSTITUTE CONSIDERED

At a conference December 10, 1951, about one hundred representatives of agricultural industries, government agencies, research institutions, and farm organizations considered a proposal of leading industrial scientists to organize an Agricultural Research Institute.

The objective of the ARI would be to further the kinds of agricultural research and practices needed to insure the best long-time utilization of the nation's agricultural resources.

The proposal suggested that the attainment of this objective might best be accomplished through the facilities of the Agricultural Board under the Division of Biology and Agriculture in the National Research Council. The National Research Council is an agency of the National Academy of Sciences, an independent, non-profit organization designed to stimulate research, to survey the larger possibilities of science, and to promote collaboration and develop effective means of utilizing the nation's scientific resources. National Research Council work is accomplished by cordial cooperation of academic, governmental and industrial scientists without compensation.

Membership in the ARI would be open to companies which process or sell agricultural products and those which manufacture materials or machinery used in agriculture, to farm and trade organizations, and to institutions and experiment stations which conduct research beneficial to agriculture. The last-named would be admitted without assessment of dues.

The group assembled favored the proposal and agreed to pursue the establishment of the ARI under the auspices of the National Research Council following the patterns set by existing groups, such as the Industrial Research Institute, the Highway Research Board, and the Building Research Institute.

The National Research Council was requested by the conference to appoint an organizing committee to draft bylaws and fiscal procedure acceptable to the NAS-NRC. These are to be presented for adoption at a later conference if a sufficient membership in the Institute can be assured to warrant its initiation. Some of the industrial representatives present committed their companies to immediate participation in the expenses pursuant to organizing the ARI and a large majority voted to recommend participation to their management.

FUTURE DATES FOR FOOD TECHNOLOGISTS

May 11-15	Super Market Institute, Annual Super Market Convention, Cleveland Public Auditorium, Cleveland, Ohio.
May 25-28	Flavoring Extract Manufacturers' Association, Annual Convention, Edgewater Beach Hotel, Chicago, Ill.
June 1-5	National Confectioners' Association, Annual Convention and Exposition, Hotel Conrad Hilton, Chicago, Ill.
June 8-12	**Institute of Food Technologists, Twelfth Annual Meeting, Grand Rapids, Mich.**
June 19-22	American Plant Food Council, Annual Meeting, The Homestead, Hot Springs, Va.
June 24-26	American Dairy Science Association, Annual Meeting, Davis, Calif.
July 2-4	Annual Convention, Australian Section, IFT. Hawkesbury Agricultural College, Richmond, N. S. W.
August 4-8	Food and Nutrition sessions, Gordon Research Conferences, AAAS, New London, N. H.
Sept. 29-Oct. 1	Association of Official Agricultural Chemists, Annual Meeting, Shoreham Hotel, Washington, D. C.

(Information concerning future dates of national and international meetings, conventions and exhibits of interest to food technologists should be sent to the editorial office.)

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Regional Section News

DIXIE SECTION

The spring meeting of the Dixie Section, held at Atlanta, Georgia, March 14, 1952, featured a program on the application of electronic control instruments to food processing and research. Mr. Roy W. Freeman of the Brown Instrument Division of the Minneapolis Honeywell Regulator Co., delivered an informative talk on the subject, illustrating with projector slides and instruments.

Business conducted during the meeting consisted of the reports from the Nominating, Technical Meeting, and Student Award Committees.

The next meeting of the Dixie Section will be held in May, and will feature the election of officers and the annual student awards.

FLORIDA SECTION

The Section met on March 13 at the Haven Hotel, Winter Haven, Fla., when Dr. E. J. Cameron, Director of Research, National Canners Association, Washington, D. C., was the speaker. His subject was "Present Status of Cold Sterilization of Foods with Ionizing Radiations." Members of the Florida Canners Association also attended this meeting.

On March 27, Dr. R. H. Lueck, General Manager, Research and Technical Department, American Can Company, New York, N. Y., addressed the Section on "Tin Conservation in the Citrus Industry." The meeting was held in the Las Novedades Restaurant, Ybor City, Tampa, Fla. Members of the Florida Canners Association and other citrus organizations were also invited to this meeting.

NORTHEAST SECTION

Two speakers addressed the Section's April 3rd meeting held in the Hotel Brunswick, Boston, Mass. Mr. Frank Leslie Hart, Chief of the Boston District, United States Food and Drug Administration, gave a talk on the "History of Food Adulteration." His address brought out a number of odd facts and laws dating back to the Ancient Chinese. Second speaker was Mr. Norman W. Kempf, Manager of Research, Walter Baker Division, General Foods Corporation, Boston. Mr. Kempf gave an informal report on his recent visit to Brazil and showed a movie that he took during his stay. The film dealt with the processing and handling of cocoa beans.

The Section reports that its "Ladies' Night" held on March 6 was a tremendous success, having an attendance of 92 persons. It is planned to continue this type of meeting next year. Incidentally, Dr. Frederick J. Stare of the Harvard School of Public Health was the speaker this year and his subject dealt with nutrition from the point of view of processing, advertising and promotion and the responsibility of food manufacturers to sell nutrition to the public.

AUSTRALIAN SECTION

The Australian Section held a meeting in Sydney, N. S. W., on January 24th. The Chairman, Dr. J. R. Vickery, on being welcomed home after an extensive trip abroad, gave an account of his meetings with officials of the IFT, and of his pleasant visits with IFT Sections. The main business of the evening was an address by Mr. Kevin Smith of the Southern Can Company on "Recent Developments in Vegetable Canning." Mr. Smith spoke particularly on technical advancements in the canning of peas and green beans and of developments in the manufacture of tin plate and cans. The talk was illustrated with a fine set of color slides.

The Second Annual Convention of the Australian Section will be held at the Hawkesbury Agricultural College, Richmond, N. S. W., July 2nd to 4th. An invitation is extended to IFT members in New Zealand, the United States and elsewhere to attend. Details of the program and reservations for accommodation are available through the Sectional Secretary.

OHIO VALLEY SECTION

The Section met on February 15 and 16 at Louisville, Ky., when some 90 members enjoyed an excellent program, including field trips through the Grocers Baking Co., Gordon Foods, Joseph E. Seagram & Sons, Inc., and the Pillsbury-Ballard Division of Pillsbury Mills. The group was honored by several outstanding speakers including: Dr. Lawrence V. Burton, Packaging Institute, New York, who spoke on "Sense and Nonsense about Packaging"; Dr. Lucius W. Elder, General Foods Corp., Hoboken, N. J., on "Laboratory Acceptance Testing"; Dr. Douglas Sherow, Stokely-Van Camp, Indianapolis, Ind., on "Water and Its Effect on Canned Vegetables." Dr. Dean Foster, Kingan and Co., Indianapolis, discussed "A New Method for Predicting the Qualities of Flavor Mixtures"; Dr. John P. Bolanowske, Girdler Corp., Votator Division, Louisville, took as his subject "Rapid Heat Transfer and Its Utilization in Modern Food Industry"; and Mr. Moe Salworth of the Chemco Co., Louisville, gave a talk on "Industrial Sanitation."

CHICAGO SECTION

Speaker for the March 17th meeting was Dr. Walter M. Urbain, Assistant Director of Research, Swift and Company. Subject was "The Cold Sterilization of Foods With Electron Beams and X-rays." This subject is very timely with the increased emphasis on use of some of the by-products from the Atomic Energy Commission. It is extremely interesting because of the appeal of a sterilization method which does not require heat or chemicals. Dr. Urbain reviewed the work that has been done with Cathode rays and X-rays developed by machines and the use of Beta and Gamma radiation produced by radioactive materials. He discussed in particular the work being carried on at the Massachusetts Institute of Technology and at the Electronized Chemical Corporation in Brooklyn. An unusually large number of members, 124, turned out.

(Continued on page 12)

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Regional Section News

(Continued from page 10)

Inasmuch as we have not reported in FOOD TECHNOLOGY since the beginning of our Fall season, we list below the subjects that have been presented at monthly meetings and the speakers.

October: "Trends in Canning Crop Production and Quality Control in the Field," by Dr. F. W. Geise, Manager of the Agronomy Department of American Can Co.

November: "Statistical Quality Control," by Dr. L. B. Anderson, Technical Assistant to Development Director Research Division, Armour & Company.

December: "Lighting of Food Processing Operation," by Mr. William D. Richards, Illumination Engineer, Chicago Lighting Institute.

January: "The Use of Radioactive Tracers in the Food Industry," by Dr. Robert R. Baldwin, Director of the Biochemical Laboratory, General Foods Corp., Hoboken, New Jersey.

February: "Fundamental Beef Properties Associated With Organoleptic Quality," by Dr. D. M. Doty, Assistant Director, American Meat Institute.

Section officers elected for the year 1952 are as follows:

Chairman: V. O. Wodicka, Libby, McNeil & Libby, Blue Island, Ill.

Vice Chairman and Section Councilor: G. E. Brissey, Swift & Co., Chicago 9, Ill.

Treasurer: E. W. Hopkins, Armour & Co., Chicago 9, Ill.

Secretary: D. A. Huber, Q. M. Food & Container Institute, Chicago, Ill.

Executive Committee 1952-1953: R. H. Maher, Swift & Co., Chicago 9, Ill.; Randall Royce, American Can Co., Maywood, Ill.

Section Councilor 1952 -1953: W. J. Mutschler, Continental Can Co., Chicago, Ill.

Sixth Regional Section Councilor: John M. Jackson, American Can Co., Maywood, Ill.

PUGET SOUND SECTION

The February meeting of the Section was held at Sick's Century Brewery, Seattle, Wash., where the members were introduced to Mr. M. Baker, Vice President in charge of economic research of the First National Bank of Washington, Seattle. Mr. Baker presented a complete economic analysis of the developing pattern of Northwestern industries. With particular attention directed to the food industries, he portrayed their expected progress in the light of related industries and the State's resources. To the heads of expanding firms and to the progressive food industrialist the subject gave an excellent background for sound financial guidance. After this excellent economic presentation, a business session was held by the members with major emphasis given to preparations for the Donor's Banquet to be held at the Chamber of Commerce Hall in Seattle on April 24. This banquet formulated by contributions from food and related industries of the Pacific Northwest should prove to be the social highlight of the year and will demonstrate the far reaching manufacturing and processing capabilities of the industries in the northwest.

Following the business meeting the members enjoyed a tasty buffet lunch served with Sick's Select Beer to

PERSONNEL

COLONEL G. I. ADCOCK of Jusfrute Ltd., Gosford, N. S. W., Australia, is on a tour of North America and accompany the generous hospitality from Sick's Seattle Brewing and Malting Company.
Europe to study developments in the citrus juice and carbonated beverage industries.

FRANKLIN W. BARBER has been appointed Division Leader, Division of Microbiology of National Dairy Research Laboratories, Inc., Oakdale, Long Island, New York. For the past two years Dr. Barber has been Acting Division Leader.

BERTON S. CLARK, American Can Company, Maywood, Ill., has been appointed Chairman of the Research Committee of the Can Manufacturer's Institute, Chicago.

VICTOR CONQUEST, General Manager, Research Division, Armour & Co., WARREN H. GOSS, Associate Director of Research and Development, Pillsbury Mills, Inc., Minneapolis, Minn., and CURT E. MAIER, General Manager, Research Division of Continental Can Company, Chicago, Ill., received "Certificate of Appreciation Awards" from the Army, signed by the Honorable Frank Pace, Secretary of the Army, for services on the Technical Industrial and Intelligence Committee during World War II.

ERNEST C. CROCKER of Arthur D. Little, Inc., of Boston, Mass., an Associate Editor of FOOD TECHNOLOGY, spoke on March 17 to the Chicago, Ill. meeting of TAPPI on the subject "The nature of odor."

ANDREW DAWES, formerly of Paul-Lewis Laboratories, Chicago, Ill., has taken over the position of Director of Research of the Miller Brewing Company, Chicago, Ill.

JOHN C. GAREY has been appointed as Manager of the Special Yeast Products Division of Red Star Yeast and Products Company of Milwaukee, Wis.

EDWARD W. HUBER, Vice-President and master brewer of the Miller Brewing Company, Chicago, Ill., was elected president of the newly formed Brewing Industries Research Institute in Milwaukee, Wis.

BERNARD E. PROCTOR, Professor of Food Technology and Director of the Samuel Cate Prescott Laboratories of Food Technology at MIT, has been appointed Head of the Department of Food Technology at MIT. Dr. Proctor is President-Elect of the IFT.

J. R. VICKERY, Chairman of the Australian Regional Section of the IFT, and his associate, DR. HOWARD, visited food and allied companies in Chicago recently. Dr. Vickery is Chief of the Division of Food Preservation and Transport, Australian Commonwealth Scientific and Industrial Research Organization.

J. N. VINCENT has been appointed to the position of manager of the Company's Customer's Plant Layout Department of the Continental Can Company, New York, N. Y.

Blast Cans Dry with AIR

NEWLY DESIGNED AIR BLAST CAN DRYER DRYS CANS AT HIGHEST SPEEDS WITH COOL BLASTS OF AIR

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Cutaway view of air chamber shows how directional air blasts curb random diffusion of water, wiping cans dry as they progress through the machine.

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VERY LOW DUST CONCENTRATION MEASURED BY NEW METHOD

In developing synthetic liquid fuel processes, the U. S. Bureau of Mines has found that when vast volumes of gas are compressed, as has to be done in these processes, the slightest traces of dust in the gas can destroy the compression machinery in a few minutes. To create automatic devices which would prevent such damage, the Bureau developed special methods for measuring these very low dust concentrations.

It is now possible to test new low-dust-concentration detecting instruments developed for the Bureau. These instruments made a continuous and automatic determination of the dust in highly purified gas and give instantaneous warning when the dust concentration rises above an amount that is dangerous to the compression machinery. These new instruments use two photocells, the electrical outputs of which feed into an electrical instrument which gives a meter reading corresponding to the dust concentration in the gas. Instruments so far developed can measure concentrations as low as three-fourths of a grain per 100 cubic feet of gas. Work is going forward to develop instruments which can measure still lower concentrations.

The methods to test these instruments and the new dust-measuring devices themselves are described in "Report of Investigations 4782, Investigation of a Photoelectric Device for the Determination of Low Concentrations of Dust." A limited number of copies are available without charge upon request to the Publications Distribution Section, U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh 13, Pa.

Another report "PB 103 260, Investigation of a Photoelectric Device for the Determination of Low Concentrations of Dust," 13 pages including photographs, diagrams, graphs and tables, is available from the Library of Congress Photoduplication Service, Publication Board Project, Washington 25, D. C. at $1.75 in microfilm or $2.50 in photostat. Orders should be accompanied by remittance payable to the Librarian of Congress. [From *Aminco Lab. News* **8** (5) 10 (1951) September.]

NEW ELECTROSTATIC FISH SMOKER DEVELOPED

A factory in the German Federal Republic has recently developed a new electrostatic smoker which will process fish in twenty seconds instead of the usual 1 to 2 hours, a June 18 American consular dispatch from Hamburg announces.

The fish are carried on a conveyor belt through a smoke chamber located in a high tension field. Small nozzles conduct the smoke to the copper wire negative which has the effect of instantly charging the smoke particles. The particles thus charged penetrate the fish at high speed. The fish are located on metal plates which function as the opposite pole. After this process, the fish are exposed to infra-red radiation which completes the curing process. [From *Com. Fisheries Rev.*, **13** (8) 35 (1951) August.]

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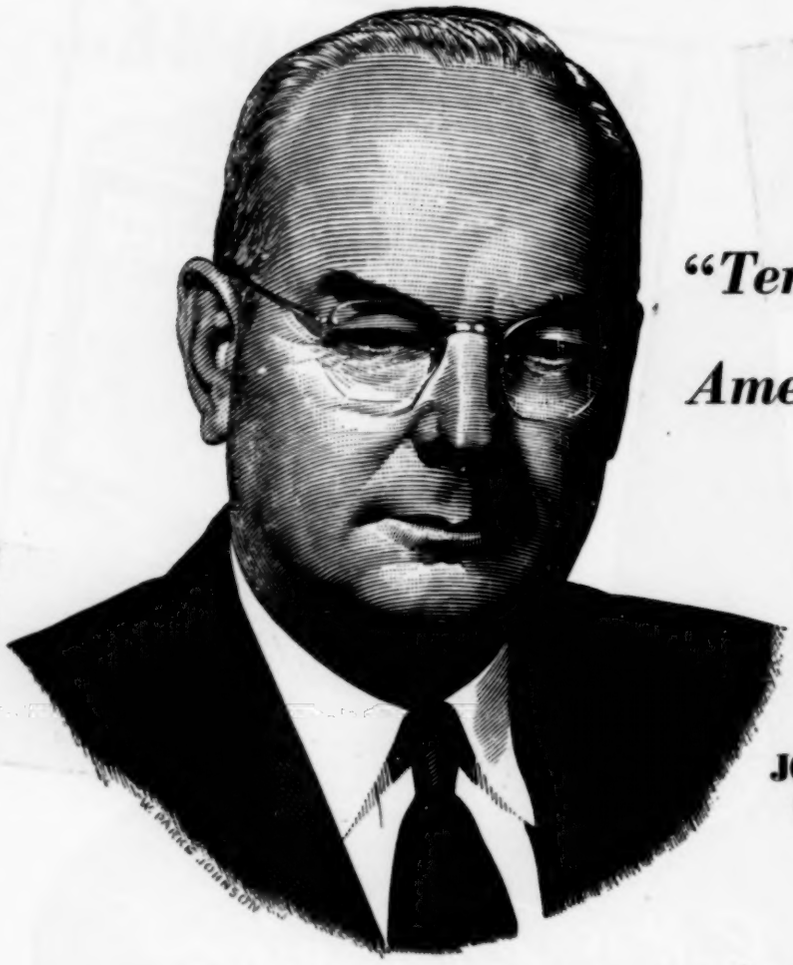

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- In the January-September, 1951, period, 33,418,000 $25 E Bonds were purchased—a gain of 17% over the same period of 1950. 8,966,000 $50 E Bonds were sold in the first nine months of 1951. *$25 and $50 denominations are the bonds bought by Payroll Savers.*

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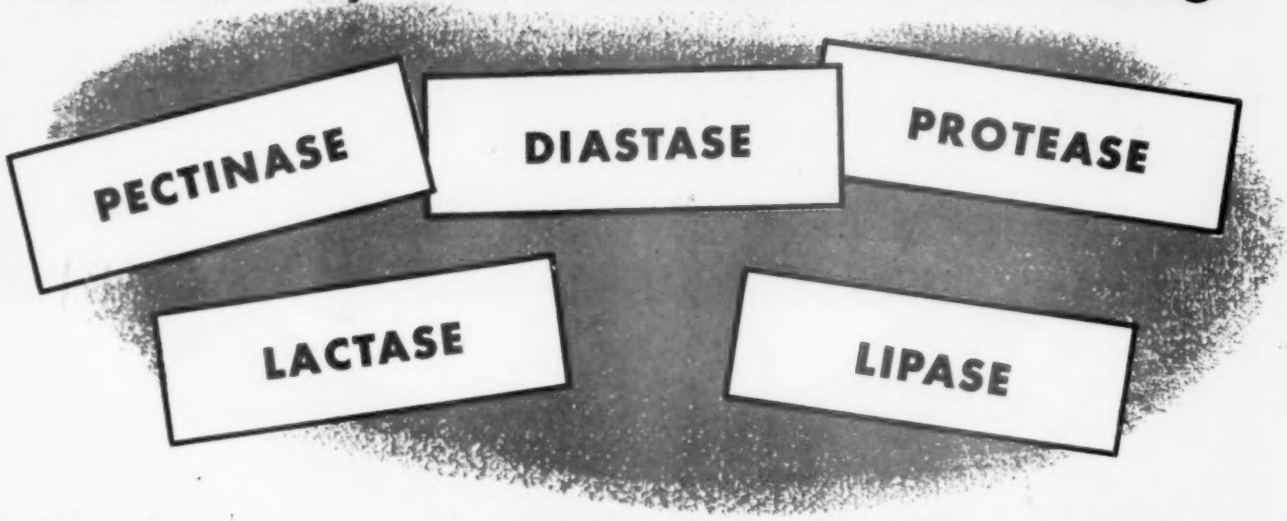

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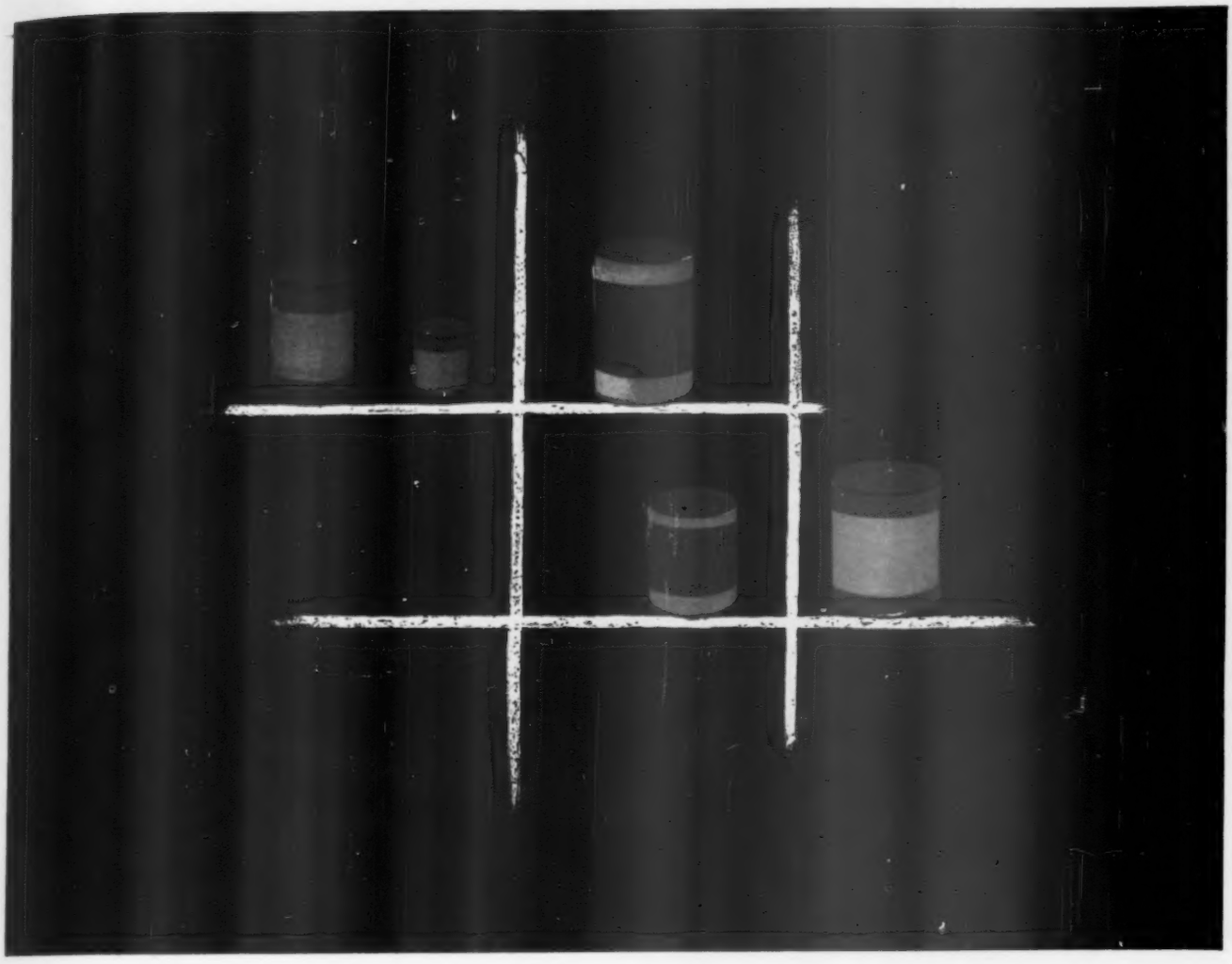

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Selected Abstracts*

ANALYTICAL METHODS

Chromatography of amino acids on sulfonated polystyrene resins.

MOORE, S., AND STEIN, W. H. *J. Biol. Chem., 192,* 663 (1951).

A procedure is described for the chromatographic fractionation of mixts. of amino acids by elution analysis on columns of Dowex-50, a sulfonated polystyrene resin. On a 0.9 × 100 cm. column operated in the sodium form, elution of amino acids is effected by the use of buffers of progressively increasing pH, from 3.4 to 11. In expts. with synthetic mixts. of amino acids simulating the compn. of protein hydrolysates, a sequence of buffers has been developed which yields in a single chromatogram an effluent curve in which every component emerges as a discrete peak. For analytical work, 3 to 6 mg. of the amino acid mixt. are required per chromatogram. Integration of the curves has given quant. recoveries (100 ± 3% on the av.) for all except the basic amino acids. These latter may be detd. with the aid of a second column, 0.9 × 15 cm. with buffers in the range pH 5 to 6.8. The position of emergence of some of the less common amino acids and related compds. has also been detd. The resin columns possess higher resolving power than starch columns and are more convenient to operate. An amino acid analysis of a protein hydrolysate can be carried out in about half the time required with starch. The performance of the ion exchange column is not adversely affected by the presence of inorg. salts in the material chromatographed. Accordingly, blood plasma dialysates and urine may be fractioned directly without preliminary salt removal.

Separation and estimation of saturated C_7- C_1 fatty acids by paper partition chromatography.

REID, R. L., AND LEDERER, M. *Biochem. J., 50,* 60 (1951).

A method is described by which steam-volatile satd. fatty acids can be sepd., identified, and estd. by paper-partition chromatography. The acids are run upward on paper as their ammonium salts using *n*-butanol-aq. ammonia as solvent system. The free fatty acids appear as yellow spots on a purple background after the developed chromatogram is sprayed with a bromocresol purple soln. contg. formaldehyde. Fatty-acid content can be calcd. from spot area because of the direct relationship between spot area and the logarithm of acid content. Fatty acids of the normal series from acetic to heptanoic can be sepd., identified and estd. with an accuracy of ± 2-5% for each acid. Heptanoic acid cannot be sepd. from octanoic and nonanoic acids; octanoic acid can only be estd. in the absence of heptanoic and nonanoic acids. Isomeric acids cannot be sepd.

A method for corn-sirup analysis involving selective adsorption.

MCDONALD, E. M., AND PERRY, R. E. *J. Research Nat. Bur. Standards, 47, 363* (1951).

A chromatographic method is described for the sepn. of corn sirups into dextrose, maltose, and dextrin fractions. The sample is absorbed on a Darco column; sepn. of the components is effected by using water, a 5%-ethanol in water soln. as eluting media. Pressure is used to increase the flow rate.

Microdetermination of glycerol.

BRADBURY, R. B. *Mikrochemie ver. Mikrochim. Acta, 38,* 114 (1951); *J. Am. Oil Chemists' Soc., 28,* 446 (1951).

The test depends on hydrolyzing a fat with 50% aq. KOH and converting the freed glycerol to isopropyl iodide with HI in the presence of propionic acid. The reaction $C_3H_{10}O_3 + 3\,HI = (CH_3)_2\,CHI + 3\,H_2O + I_2$ takes place, and the liberated I is collected in a soln. contg. Br, acetic acid, and sodium acetate which oxidized the I to IO_3. At the end the excess Br is removed by adding HCO_2H, H_2SO_4 + KI and the liberated I is titrated with 0.02 N $Na_2S_2O_3$.

Determination of furfuraldehyde in distillation of pentoses and uronic acids with hydrochloric or hydrobromic acid.

FUCHS, L. *Mh. Chem., 81,* 70 (1950); *Brit. Abstracts, C,* 370 (1951).

Furfuraldehyde has 2 distinctive absorption max. at 277 mμ and 229 mμ. The curve is not altered by small quantities of HCl, but the value of log ε-% is lowered about 24% if the furfuraldehyde is heated for 1 hr. with 13% HCl. Given this as an empirical conversion factor, ultra-violet absorption at these wave-lengths gives values sufficiently accurate to det. 0.1-0.4 mg. of furfuraldehyde in 100 ml. of distillate. The absorption curve is completely altered by HBr. Pptn. with barbituric acid leaves 3-20% of the furfuraldehyde in soln.; empirical conversion factors are given, derived from the spectrographic detns. Hydroxymethylfurfuraldehyde has a similar spectrum curve to that of furfuraldehyde; methylfurfuraldehyde shows a shift to the red end of the spectrum of about 15 mμ.

Identification of the free carboxyl groups in peptides.

TIBBS, J. *Nature, 168,* 910 (1951).

The Schlack and Kumpf procedure for identifying the amino acids which provide terminal carboxyl groups in peptides has been used for studying free α-carboxyl groups in proteins.

The titrimetric determination of carbon dioxide liberated in the ninhydrin reaction with amino-acids.

SMITH, A. M., AND AGIZA, A. H. *Analyst, 76,* 619 (1951).

The α-amino nitrogen in single amino-acids or in mixts. can be accurately detd. by measuring the carbon dioxide released by ninhydrin. A simple and convenient unit for the purpose and exptl. conditions suitable for a quant. reaction are described. Recoveries of from 97 to 102% were attained with amts. corresponding to about 0.15 mg. of α-amino nitrogen.

Detection of citrus pulp in non-citrus jams.

SAMISCH, Z., AND FEIGENBAUM, J. *Food Research, 16,* 474-6 (1951).

A simple qual. method is reported for the microscopic detection of citrus pulp in fruit jams, as tested in apricot and plum jams. This method may lend itself to semi-quant. work.

BIOLOGICAL SCIENCES

BIOCHEMISTRY

Use of I^{131} labeled protein in the study of protein digestion and absorption.

LAVIK, P. S., AND MILLER, R. W. Western Reserve Univ. School Med., April 16, 1951; *Nuclear Sci. Abstracts, 15,* 782, No. 5026 (1951).

A method is described by which the rate of protein digestion and absorption in the gastrointestinal tract can be readily estd. *in vivo.* It consists simply of measuring the uptake of radioactivity in the blood after feeding a test meal of protein that has been iodinated with I^{131}. The expt. consisted of establishing normal absorption curves for each dog before and after depancreatizing. The depancreatized dogs showed a decreased I^{131} uptake in the blood when fed a test meal of I^{131} labeled protein. The max. deviation from normal occurred 60 min. after the protein meal was gavaged. The method may be of some value in the diagnosis and study of certain digestive disorders in the human, specifically, the method could be employed in estg. the relative activity of proteolytic enzymes in the gastrointestinal tract.

Studies in glycine-2-C^{14} metabolism in man. I. The pulmonary excretion of $C^{14}O_2$.

BERLIN, N. I., TOLBERT, B. M., AND LAWRENCE, J. H. Univ. Calif. Radiation Lab., September 1, 1950; *Nuclear Sci. Abstracts, 15,* 783, No. 5031 (1951).

(Continued on page 24)

* These Selected Abstracts are made available to FOOD TECHNOLOGY through the cooperation of Associate Editor H. A. Campbell and the General Foods Corporation of New York, N. Y. The abbreviations found in these abstracts are similar to those used by Chemical Abstracts.

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Alva FLAVORS

Abstracts

(Continued from page 20)

The rate of excretion by man of C^{14} via the lungs when administered as glycine 2-C^{14} in 3 patients has been detd. This pulmonary excretion has been described in terms of 3 rate processes, the slowest of which has a half time of 7 to 14 days. In 55 days approx. 83 to 92% of the C^{14} is excreted via the lungs, 5% via the urine, and 2% is retained in the red blood cells during their life span. The lack of hazard involved in the use of C^{14} in the manner described is discussed from the standpoints of excretion and possible retention in chem. compds. having a long turnover time.

The intestinal absorption of triglycerides.

REISER, R., BRYSON, M. J., CARR, M. J., AND KUIKEN, K. A. Texas Agriculture Experiment Station; *Nuclear Sci. Abstracts, 15,* 781, No. 5024 (1951).

A study was made of the mechanism of fat absorption in the intestine by use of synthetic triglycerides in which the glycerol was labeled with C^{14} and the fatty acids with conjugated double bonds. A study of the resultant lymph lipids led to the following conclusions: (1) Approx. ⅔ of ingested triglycerides are not hydrolyzed during absorption. (2) The hydrolyzed fat is completely split, little or no mono-glycerides being formed. (3) Hydrolyzed glycerol is not utilized for resynthesis of lymph triglycerides but follows an independent metabolic pathway. (4) Half the lymph phospholipid formed from ingested fat utilizes the hydrolyzed fatty acids only. The other half is synthesized from unhydrolyzed fat by the substitution of one fatty acid mol. by the phosphate group.

The stepwise degradation of peptides.

WALEY, S. G., AND WATSON, J. *J. Chem. Soc.,* 2394 (1951).

A method for the elucidation of the amino-acid sequence in peptides by conversion of the residue bearing a terminal carboxyl group into a thiohydantoin has been further investigated. By use of paper chromatography it has been found advantageous to identify the terminal residue as the amino-acid. Application of the method to insulin has revealed alanine as a terminal amino-acid.

Chlorophyll.

ARANOFF, S. *Botan. Rev., 16,* 525 (1950); *Brit. Abstracts, BII,* 624 (1951).

A review with an extensive bibliography.

Effect of oral terramycin prior to whole body X-radiation.

GUSTAFSON, G. E., AND KOLETSKY, S. *Proc. Soc. Exptl. Biol. Med., 78,* 489 (1951).

Oral administration of terramycin has been shown to be effective in reducing the mortality in rats when administered for 48 hours prior to 660r of whole body x-radiation. The antibiotic presumably reduced the incidence of bacteremia following radiation.

Toxicity studies on subtilin.

WILSON, R. H., DEEDS, F., AND RATHER, L. J. *Proc. Soc. Exptl. Biol. Med., 78,* 517 (1951).

Feeding rats on diets contg. 0.1% subtilin for 220 days was not detrimental as judged by growth, activity, organ wts., and macroscopic and microscopic appearance of the tissues.

Vapor toxicity of trichloroethylene determined by experiments on laboratory animals.

ADAMS, E. M., SPENCER, H. C., ROWE, V. K., MCCOLLISTER, D. D., AND IRISH, D. D. *Arc. Ind. Hyg. Occup. Med., 4,* 469 (1951).

Groups of rats were exposed to trichloroethylene vapor for single periods on a varying concn. time basis. The results permitted the graphing of lines representing the following conditions: (1) the least severe single exposures causing death of 100% of the animals; (2) the most severe single exposures permitting survival of 100% of the animals; (3) the most severe single exposures without death or org. injury. Four animal species were exposed 7 hours daily, 5 days a week, to trichloroethylene vapor for about 6 months. Max. trichloroethylene concns. without adverse effects were as follows: monkey, 400 p.p.m.; rat and rabbit, 200 p.p.m.; guinea pig 100 p.p.m. It is concluded that for uniform daily exposures of about 7 hours' duration there is little probability of any adverse effects on human subjects if trichloroethylene concns. are kept below 200 p.p.m.; the probability of any effect whatsover is extremely small if concns. are kept below 100 p.p.m.

Vapor toxicity of ethylene dichloride determined by experiments on laboratory animals.

SPENCER, H. C., ROWE, V. K., ADAMS, E. M., MCCOLLISTER, D. D., AND IRISH, D. D. *Arc. Ind. Hyg. Occup. Med., 4,* 482 (1951).

Rats were exposed to ethylene dichloride vapor for single periods on a varying concn. time basis. The results were treated statistically and permitted the graphing of lines representing the single exposures causing death in 0.01, 50, and 99.99% of the animals. Four animal species were exposed for seven hours daily, five days a week, to ethylene dichloride vapor for six months. Max. vapor concns. without adverse effect were as follows: rabbit 400 p.p.m.; rat 200 p.p.m.; monkey and guinea pig 100 p.p.m. It is concluded that for uniform daily exposures of about seven hours' duration there is little probability of any adverse effect on human subjects if the ethylene dichloride concns. are kept below 100 p.p.m.

BOTANY

The path of carbon in photosynthesis; the carboxylic acids.

BASSHAM, J. A. Univ. Calif., Radiation Lab., June, 1945; *Nuclear Sci. Abstracts, 15,* 782, No. 5030 (1951).

Methods have been developed for the sepn., isolation, identification, and degradation of the carboxylic acids formed in the reduction of CO_2 during photosynthesis. These methods have been applied, and the results indicate that the primary reduction of CO_2 during photosynthesis takes place via 2 carboxylations of a 2-carbon acceptor followed by splitting and reduction of the resulting 4-carbon acid to 2 new molecules of acceptor. One mol. of acceptor is then used to continue the reductive cycle and the other is used in photosynthesis. The participation of 2-phosphoglyceric acid, phosphoenolpyruvate, phosphoenoloxalacetate, and glycollate in the cycle are discussed, and a tentative cycle is proposed. 12 figures.

MEDICINE

Aid in blood disorder.

Science News Letter, 60, 322 (1951).

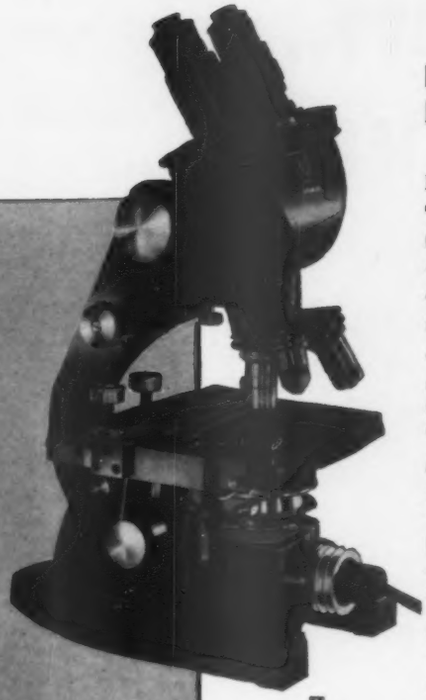
A B-complex vitamin called the citrovorum factor and closely related to folic acid has been isolated. It was obtained as a pure cryst. salt from horse liver. Although the pure vitamin has not been tried in man or against human disease, lab. tests have shown it to be more active than either folic acid or the derivs. of folic acid which formerly were thought to be the citrovorum factor.

Decreased resistance of pyridoxine-deficient rats to cold exposure.

ERSHOFF, B. H. *Proc. Soc. Exptl. Biol. Med., 78,* 385 (1951).

Rats raised to maturity on a pyridoxine-deficient diet readily succumb following cold exposure but continue to survive on a similar diet under room conditions. The cause of death is probably due to a failure of the mechanism of adjustment to cold. This is indicated by the fact that no significant reduction occurred in the survival of rats fed a pyridoxine-deficient diet when such animals were placed in the cold prior to the time they were pyridoxine-deficient. It would appear, therefore, that pyridoxine is essential for optimal adjustment to cold but that dietary sources of this vitamin are dispensable for survival once adjustment to cold has occurred.

(Continued on page 26)



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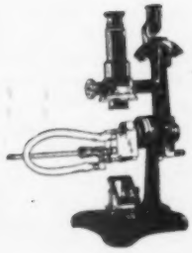

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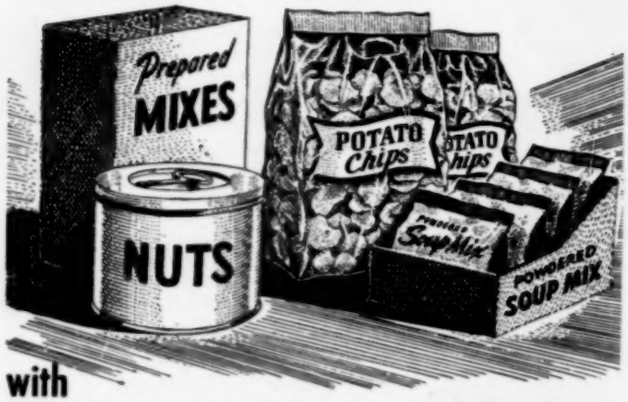

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The effectiveness, ease of use and economy of Diamond Crystal Antioxidant Salt will more than justify its test in your operation. Samples are available upon request. Send for yours right away! For further information, write to Technical Director, Diamond Crystal-Colonial Salt Division, General Foods Corporation, St. Clair, Michigan.

DIAMOND CRYSTAL
Antioxidant SALT

Abstracts

(Continued from page 24)

New vitamin discovered.

Science News Letter, 60, 322 (1951).

A new vitamin, lyxoflavin, related to riboflavin vitamin B_2 has been isolated by Merck Institute for Therapeutic Research scientists. Its existence in human heart muscle was reported in the Archives of the Institute of Cardiology in Mexico in 1947. Human patients with high blood pressure reported feeling more relaxed when they received the vitamin. Blood pressure measurements showed no change, however, there is also a possibility of anti-cancer action by this vitamin.

MICROBIOLOGY

Relative pathogenicity of certain Salmonella strains for man and mice.

McCULLOUGH, N. B. *Public Health Repts., 66,* 1538 (1951).

The pathogenicity for man of 3 strains each of *Salmonella meleagridis* and *Salmonella anatum* and 1 strain each of *S. newport, Salmonella bareilly,* and *S. derby* were detd. by administering these organisms to human volunteers. The ID_{50} for mice, using the intra-abdominal route, was detd. for each strain. There was no apparent relationship between the pathogenicity of these strains for human volunteers and the ID_{50} for mice.

NUTRITION

The calcium balance of adult human subjects on high and low fat (butter) diets.

STEGGERDA, F. R., AND MITCHELL, H. H. *J. Nutrition, 45,* 201 (1951).

Calcium metabolism studies have been reported on 13 adult men, ranging in age from 19 to 44 years, involving 50 expt. periods of 12 to 20 days duration. The main purpose of the investigation was to study the effect of variable dietary levels of milk fat, from 1 to 32% on the dry matter basis, on the utilization of dietary calcium, an av. of 47% of which was derived from milk. For the type of dietary fat studied and the range of intake employed, no effect on calcium metabolism was noted, either in the amt. retained or in the proportion of excreted calcium found in the feces.

Calories—a limiting factor in the growth of children.

MACY, I. G., AND HUNSCHER, H. A. *J. Nutrition, 45,* 189 (1951).

Values illustrating pertinent aspects of the relation of calorie intake to growth were selected from the published data of a comprehensive study of nutrition and chem. growth in childhood. The values demonstrate: Wide variation in the growth progress of the same child at different times and of different children at the same time. That appetite may not be relied upon to assure ingestion of quantities of a good mixed diet which will provide sufficient calories for satisfactory wt. gains. That existing "standards" may not be depended upon in every instance as criteria of dietary adequacy. A depression of nitrogen retention when intake of calories is insufficient to permit proper gain in body wt. That invisible growth may occur, as evidenced by nitrogen retention, coincident with failure to accomplish satisfactory gains—or even with a loss—of body wt. That a difference in intake of as few as 10 cal. per kilogram of body wt. may spell success or failure in making satisfactory progress in visible and invisible growth.

Nutrition and aging.

KIRK, J. E. *Nutrition Revs., 9,* 321 (1951).

A review of work over the last 5 years.

Growth-promoting effect of aureomycin on young calves weaned from milk at an early age.

RUSOFF, L. L., DAVIS, A. V., AND ALFORD, J. A. *J. Nutrition, 45,* 289 (1951).

(Continued on page 28)

ADVERTISEMENT

STERILIZING WITH ELECTRONS

High Voltage Engineering Corporation will exhibit new electron sterilization technique

A member of Massachusetts' famous Research Row will exhibit its new electron sterilization equipment at the IFT Convention in Grand Rapids next month. One of the many U. S. companies to step from the engineering and physics laboratories of MIT into industry, the High Voltage Engineering Corporation of Cambridge, Mass., has developed equipment for the application of high-energy electron radiation to the sterilization of foods and drugs. The intense electron beams produced by the multi-million-volt potentials generated with the company's Van de Graaff electrostatic accelerators are capable of completely sterilizing with only a nominal rise in product temperature.

Although considerable research has been completed on many applications, the huge potentiality of this new cold-sterilization technique for the food industry is relatively unexplored. To meet the demand for a precise and reliable research tool, High Voltage has engineered a compact electron accelerator specifically intended for research and limited production of electron-sterilized food and drug products. A scale model of this accelerator will be exhibited at the Institute of Food Technologists convention in June. One outstanding feature of the accelerator design is the electron-beam scanning system developed by High Voltage to permit handling of food products of virtually any width and to insure precise control of the electron dosages applied.

The Van de Graaff accelerator is no stranger in the fields of nuclear research, radiation chemistry, and cancer therapy. High Voltage Van de Graaff accelerators are now installed in many of the world's largest laboratories and in a growing number of hospitals. Recently a High Voltage Van de Graaff accelerator especially designed for sterilization achieved a continuous output of 12 kilowatts of electron power, making it the world's most powerful machine source of penetrating radiation. Years of careful research have assured the future of electron sterilization in the pharmaceutical industry, and the results obtained point the way for revolutionary new food processing techniques as well.

High Voltage Engineering Corporation representatives at the IFT Convention will be prepared to discuss the very recent advances in equipment design and in electron dosage control techniques which have made High Voltage the leading manufacturer in this important new industry.

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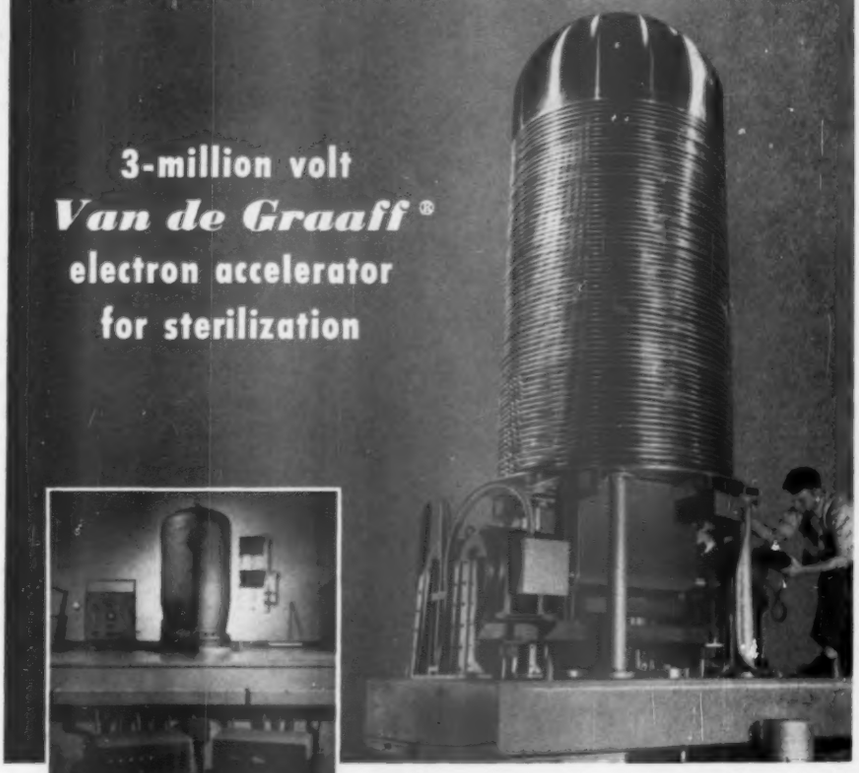

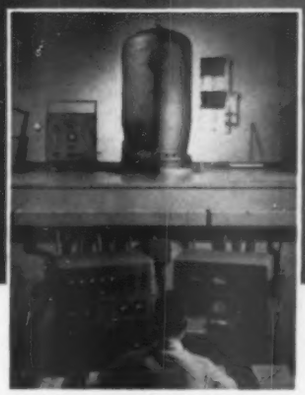

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Q. What is High-Voltage electron-beam sterilization?

A. A process whereby a controllable stream of high-energy electrons penetrates packaged or bulk product killing the included micro-organisms *without* significant product temperature rise.

Q. Is High-Voltage electron treatment safe?

A. Yes. Safety to plant and personnel is easily assured. The process does *not* produce any radioactivity in the product.

Q. Is High-Voltage electron sterilization dependable?

A. Yes. *Complete* sterility in the packaged or bulk products is consistently obtainable.

Q. Can High-Voltage electron sterilization be obtained without damage to the product?

A. Taste, appearance, and constitution of the irradiated product are unaffected in many cases. A variety of techniques are available to reduce unwanted side reactions when they occur. Each application must be studied individually to determine the electron dosage required and the methods to be used.

Q. Is High-Voltage electron treatment economical?

A. For many applications, Yes. Total treatment costs range from 5 cents per pound to a small fraction of a cent per pound, depending on the electron dosage required. Again, each product requires individual study to determine treatment cost.

Q. How can I learn more about electron sterilization for my products?

A. High Voltage has designed a compact precision unit specifically intended for application research and pilot production. Our facilities are also available for sample irradiation. We will be happy to furnish details.

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Abstracts

(Continued from page 26)

An aureomycin supplement fed at a 2% level in an all-vegetable protein calf starter ration, and cryst. aureomycin fed by capsule at a level of 75 to 150 mg. daily, stimulated the growth of Jersey and Holstein calves by 20% over that of control animals, through 16 weeks of age. The combined av. daily gain for the supplemented calves of both breeds was 1.44 lb., as compared to 1.19 lb. for the controls. Aureomycin per se was responsible for the growth-stimulating effect of the supplement and not its content of vitamin B_{12} or other factors.

ENGINEERING

Ion exchange resins in the food industry.

ONGARO, D. *Materie plastiche, 16,* 210 (1950; *Brit. Abstracts, BIII,* 309 (1951).

In the manuf. of whole fruit jam it is proposed to substitute for the sugar a concentrate derived from the juice of the actual fruit, in which the acid and salt contents have been reduced by a form of ion-exchange treatment called anionic recyclisation. In this process, the fruit juice is treated successively with an anion- and a cation-exchange resin and again passed over the anion-exchange resin while still satd. and not regenerated.

Ion-exchange in manufacture of citric acid.

PENNISI, L. *Sper. Agr., 4,* 1085 (1950); *Brit. Abstracts, BII,* 541 (1951).

Ca citrate production is improved by the Bennet-Ajon method of clarification which removes pectins, mucilage, and color; $CaCO_3$ is better than $Ca(OH)_2$ for the neutralization, giving a clearer and purer citrate. The use of ion-exchange materials is recommended in the manuf.

Practical aspects of liquid mixing and agitation.

REAVELL, B. N. Inst. Chem. Engrs., (London), July, 1951; *Brit. Abstracts, BI,* 844 (1951).

The satisfactory soln. of problems in mixing operations is necessarily based on experience rather than on theoretical considerations. Power requirements in liquid mixing may be calcd. and the study of flow patterns may be of great assistance in predicting performance. The theoretical approach to the design of equipment becomes more difficult as the η of the liquids increases. For very viscous liquids purely empirical methods are necessary. The types of rotors suitable for liquids of various η are discussed. Baffles may be used to break up a centrifugal vortex; a cruciform baffle at the bottom of a cylindrical vessel is particularly useful. Methods of driving and of mounting mixing equipment, packing glands for pressure working, and transmission in long shafts, are reviewed.

High pressure metal-to-glass fitting.

DAVIS, P. C., GORE, T. L., AND KURATA, F. *Ind. Eng. Chem., 43,* 1826 (1951).

A pressure-tight closure between a glass capillary tubing and high pressure steel tubing is described, which can be assembled by hand to seal against pressures in excess of 3000 p.s.i. under considerable vibration. Modifications of the closure would provide effective high pressure seals against a variety of brittle materials which can be formed by heating and/or grinding. These closures could be quickly dismantled and reassembled and would be more resistant to vibration than soldered or welded fittings.

FOOD PRODUCTS

BAKING AND BAKERY PRODUCTS

Problems arising from the use of chemicals in food.

AMES, A. J. *Chemistry and Industry,* 946 (1951).

Chemicals are used for flour and bread improvement and flour bleaching.

Effect of monoglycerides on starch, flour and bread: A microscopic and chemical study.

STRANDINE, E. J., CARLIN, G. T., WERNER, G. A., AND HOPPER, R. P. *Cereal Chem., 28,* 449 (1951).

Small quantities of monoglycerides in shortenings decrease the swelling or hydration of the starch granule and inhibit the release of water-sol. starch (chiefly amylose). Monoglyceride shortenings increase the softness of bread and decrease the rate of crumb firming upon storage as measured by means of a modified Bloom Gelometer. These phenomena are attributed to the effect of the monoglyceride on the starch fraction of flour.

CEREALS AND GRAINS

A century of breakfast foods.

Am. Miller., 79 (12), 30 (1951).

History of the breakfast food industry in the United States.

Improvement of protein quality of whole wheat.

BEAUDOIN, R., MAYER, J., AND STARE, F. J. *Proc. Soc. Exptl. Biol. Med., 78,* 450 (1951).

Expts. are reported showing that the cooking of whole wheat as in the prepn. of shredded wheat results in a significant improvement of the nutritional value of the whole wheat. This improvement is not lost in the prepn. of shredded wheat.

COFFEE AND COCOA PRODUCTS

Coffee.

JOLY, R. L. *Chimie et industrie, 65,* 335 (1951); *Brit. Abstracts, BIII,* 354 (1951).

The chemistry of coffee (constituents of the coffee bean, effect of roasting caffeine content of different varieties of coffee, prepn. of caffeine-free coffee) is discussed.

FISH AND SEAFOOD

Storage of frozen fish.

TRRF Inf. Bull. No. 50-1, 2-5, January, 1950; *Refrig. Abstracts, 6,* 187 (1951).

A review of basic facts including table of the probable storage life of approx. 25 frozen seafoods stored (1) round or headed and gutted, or (2) wrapped and packaged.

FLAVORS

Flavor and acceptability of monosodium glutamate. Symposium.

U. S. Quartermaster Food and Container Institute, March, 1948; *Bibl. Tech. Repts., 16,* 147 (1951).

The first symposium on monosodium glutamate, by W. Franklin Dove. History of glutamate production, by A. E. Marshall. Quality production of glutamates, by Paul D. V. Manning and B. F. Buchanan. Meat flavor and observations on the taste of glutamate and of other amino acids, by E. C. Crocker. Effect of monosodium glutamate on food flavor, by S. E. Cairncross. Taste of monosodium glutamate and other amino acid salts in dilute solns., by Stephen L. Glavin. Use of monosodium glutamate in sea food products, by Carl Fellers. Evaluation of glutamate in food specialties, by John H. Nair. Protein hydrolysates as a source of glutamate flavors, by Lloyd A. Hall. Relation of glutamate to the Browning reaction, by M. L. Anson. Significance of thresholds of taste acuity in seasoning with glutamate, by Rosaltha Sanders. Pharmacology of glutamic acid, by Carl Pfeiffer. Bibliography of monosodium glutamate and related literature, by Dr. Donald Washburn.

FRUIT AND FRUIT JUICES

Comparison of some constituents in fresh-frozen and freshly squeezed orange juice.

RAKIETEN, M. L., NEWMAN, B., FALK, K. B., AND MILLER, I. *J. Am. Dietet. Assoc., 27,* 864 (1951).

Ascorbic acid values for fresh-frozen orange juice showed a higher av. than for freshly squeezed orange juice. No significant loss of ascorbic acid took place either in fresh-frozen or in freshly squeezed orange juice when stored at ordinary refriger-

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Abstracts

ator temp. for as long as 24 hr. Carbohydrate values showed no significant difference. In freshly squeezed orange juice, the number of bacteria was far greater than in fresh frozen orange juice. Coliform organisms in significant numbers were present in freshly squeezed juice. None was present in the fresh-frozen orange juice.

Juices play increasing part in total orange consumption.

Agr. Situation, 35 (11), 11 (1951).

Nearly half of the oranges consumed by civilians in 1950 were eaten in the form of canned and frozen orange juice. This is in sharp contrast to consumption in 1941, when about one-tenth were eaten as canned juice and the other nine-tenths as fresh oranges. For 1951 it is tentatively estd. that civilian consumption of frozen orange concentrate may surpass slightly that of canned orange juice, while consumption of fresh oranges will drop to about half of the total consumption of oranges.

Citrus juices, frozen and concentrated.

TRRF Inf. Bull. No. 51-5, 2,3, May, 1951; *Refrig. Abstracts, 6,* 186 (1951).

When storage temp. is maintained at 0° F. or lower, frozen concd. citrus juices can be held approx. 1 yr.; at 5° F., 1-2 mo.; at 10-15° F., a few weeks; at 20-25° F., 15-20 days. Can corrosion is not a problem when 0° F. is maintained, at 10-15° F. corrosion may occur in about 2 mo.

FROZEN FOOD

Freezing injury to fruits and vegetables.

TRRF Inf. Bull. No. 50-12, 4, December, 1950; *Refrig. Abstracts, 6,* 184 (1951).

A review including freezing point data and susceptibility to freezing injury for approx. 40 fruits and vegetables.

GELATIN

Mechanical properties and structure of sol-type and gel-type gelatin films.

Bradbury, E., and Martin, C. *Nature, 168,* 837 (1951).

Gel-type and sol-type gelatin films have been produced by regulation of the drying temp. Mech. properties and x-ray examn. of films have been made.

INDUSTRIAL CHEMISTRY

CO_2 for rodent control.

Refrig. Research Found. Inform. Bull., 51-10, 5, October 16, 1951.

Carbon-dioxide is safer and cheaper than other methods. Initial charge of dry ice calcd. to give 20% concn, or 25 lbs. dry ice per 1,000 cu ft. A concn. of at least 15% must be maintained for 10-12 hours.

PACKAGING

The mechanical behavior of paper—Part I.

Broughton, G., and Matlin, N. A. *TAPPI, 34,* 493 (1951).

Tensile strength and elongation at break have long been used in paper specifications. Attention recently has been directed to consideration of the complete stress-strain curve rather than to an evaluation of the rupture point above. Load-elongation curves have been measured at various const. rates of elongation using the Instron Tensile Tester. Results are presented for a no. of different papers and some tentative correlations are presented.

Cohesive papers.

Modern Packaging, 25 (3), 82, November, 1951.

A description of a new principle of package sealing; coated surfaces that adhere to each other but stick to nothing else. Pressure alone is necessary for sealing, heat is not used.

Methods of rating film durability.

Flierl, D. W. *Modern Packaging, 25* (3), 129 (1951).

Specially developed instruments are described for the measurement of flex life, impact strength, and tear strength. The instruments are highly sensitive and have been developed for the testing of thin packaging films.

Predicting film durability.

SIMRIL, V. L., AND FLIERL, D. W. *Modern Packaging, 25* (4), 130 (1951).

Correlations are presented between shipping test damage and the results of various lab. tests. Lab. tests found most useful are those which measure impact and tear strengths and flex life. Failure of heavy packages is due to impact forces due to dropping. Light wt. packages fail because of flexure of the walls due to vibration. The relative ability of any group of materials to resist drop damage will not be the same as their relative ability to resist vibration damage.

PHYSICAL RESEARCH

The electron microscopy of reprecipitated collagen.

NÖDA, H., AND WYCKOFF, R. W. G. *Biochim. et Biophys. Acta., 7,* 494 (1951).

Collagen repptd. from its solns. in dil. acid may show all the fine details of structure which the electron microscope has revealed in native collagen. A study has been made of the conditions of ionic strength, pH and concn. which lead to striated repptd. collagen. Citrate buffers (0.02-0.1 M) have given best results. At values of pH between 4.6 and c. 5.0, nearly all the repptd. collagen has been well formed and striated. Above and below this region the fibrils have been thinner and usually unstriated. Pptn. with NaCl has given non-striated fibrils whose dimensions and appearance have depended on the concns. of the reactants.

The energy content of foods.

SHORT, B. E., STAPH, H. E. *Ice and Refrig., 121* (11), 23 (1951).

The specific-heat and energy content of foods to be removed by freezing, as detd. by exptl. measurement of energy supplied to food sample to raise its temp. Correlation of exptl. values versus those obtained from mixt. calcn. results.

PATENTS (BRITISH)

Manufacture of milk chocolate.

AKTIEB, S. M., HALLQUIST, B. K., AND CAMPBELL, L. O. J. Brit. Patent 637,796 (October 20, 1946); *Brit. Abstracts, BIII,* 414 (1951).

Milk chocolate made with spray-dried milk powder, in comparison with that made with roller-dried milk powder, (a) requires more fat during refining to prevent crumbling and (b) deteriorates more rapidly, because of the higher porosity (= air cells) of the powder. Using spray dried milk powder made according to B.P. 637,795 with the air content reduced to 10% by vol., the keeping properties of the finished chocolate are improved and the consumption of extra fat is reduced. When the air content is reduced to 5% by vol. or less, the keeping properties of chocolate made with it are equal to those of chocolate made with roller dried milk powder.

Process of and apparatus for treating cocoa beans.

ROCKWOOD AND CO. *Brit. Patent* 643,024 (April 11, 1947); *Brit. Abstracts, BIII,* 417 (1951).

The mucilaginous layer between the kernels and the shells of cocoa beans is softened by allowing it to absorb 0.5-10% (preferably about 3%) of water applied as a spray. The beans are passed through an atm. hot enough to sep. the shell from the nib and to roast the nib partly. It is claimed that the shell is in this way easily sepd. from the nib, the loss of valuable cocoa butter normally encountered is reduced, and that the production of undesirable cocoa fines is also reduced. Diagrams illustrating the continuous operation of the process (moistening, heating, and roasting drums, nib and shell separators, cracking app., control of heating gases, all the necessary conveyors, separators, methods of agitation, etc.) are included.

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FAO COUNCIL MEETS IN ROME HEADQUARTERS

The Twelfth Session of the Council of the Food and Agriculture Organization of the U. N., the first to assemble in FAO's new headquarters in Rome, met June 11-23, 1951, to review FAO's progress and problems since the last Council session. The representatives of 17 governments who attended the session found the FAO staff well established in Rome. All members of the Council were represented, with the exception of Venezuela. Twelve governments which are not members of the Council also had observers at the meeting, and international nongovernmental organizations were well represented.

The recommendations of the Working Party Program of Work and Long-Term Problems were presented to the Council. Included among the recommendations was a conclusion that the Conference should consider ways to provide the Organization with adequate funds to take care of the activities for which FAO is constitutionally responsible. In addition, the Working Party's recommendations set out general principles for guiding the direction of FAO's work and covered a number of other points, including the need for public information on FAO's work.

A paper giving the United States' views on the FAO's Expanded Technical Assistance Program pointed out that in the brief period the program has been in operation, 46 countries and territories had already signed or were negotiating agreements; some 226 experts from 28 countries are already in the field or are being recruited; and provision has already been made for 136 scholarships. The U. S. statement suggests several lines of improvement and mentions the importance of coordination of technical assistance programs by countries which are receiving assistance.

The Council reviewed world food and agricultural situation (including fisheries), finding that production was higher in 1950-51 than in 1949-50, but that food supplies were not satisfactorily distributed. It agreed on arrangements for the next session of the FAO Conference, suggesting how the Conference might be organized and some of the subjects that should be discussed. It decided that the date for the Conference should be November 19.

The Council learned that the FAO finished 1950 with a surplus of about $300,000, and contributions from member governments for 1951 were coming in better than they had in 1950. The question of how large the budget should be for 1952-53 was discussed, but the decision is up to the Conference. The Council agreed in principle with the recommendation of the Committee on Financial Control that the Working Capital Fund should ultimately be $2,500,000, but thought that the goal should be reached in stages. [From *Com. Fisheries Rev.*, **13** (8) 26 (1951) August.]

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Advertisers' Index

	PAGE
American Optical Co.	25
Brewers Yeast Council, Inc.	33
Distillation Products Industries	1
Dodge & Olcott, Inc.	14
Dow Corning Corp.	30
Felton Chemical Co., Inc.	21
Firmenich, Inc.	4th cover
Florasynth Laboratories, Inc.	15
Food Development Laboratory	34
Food Machinery & Chemical Corp.	13
Food Research Laboratories, Inc.	34
Food Technology, Inc.	33
Fritzsche Bros., Inc.	34
General Foods Corp. (Diamond Crystal Salt)	26
The Griffith Laboratories, Inc.	3rd cover
High Voltage Engineering Corp.	27
Hoffman-LaRoche, Inc.	18
Huron Milling Co.	31
LaWall & Harrisson	32
Magnus, Mabee & Reynard, Inc.	2
Minneapolis-Honeywell Regulator Co.	4-5
Norda Essential Oil & Chemical Co., Inc.	28
Orkin Institute	29
The Pfaudler Co.	2nd cover
Chas. Pfizer & Co., Inc.	7
Rohm & Haas Co.	17
Schwarz Laboratories, Inc.	33
Foster D. Snell, Inc.	34
Wm. J. Stange Co.	9
Sterwin Chemicals, Inc.	11
Sugar Information, Inc.	19
U. S. Treasury	16
van Ameringen-Haebler, Inc.	23

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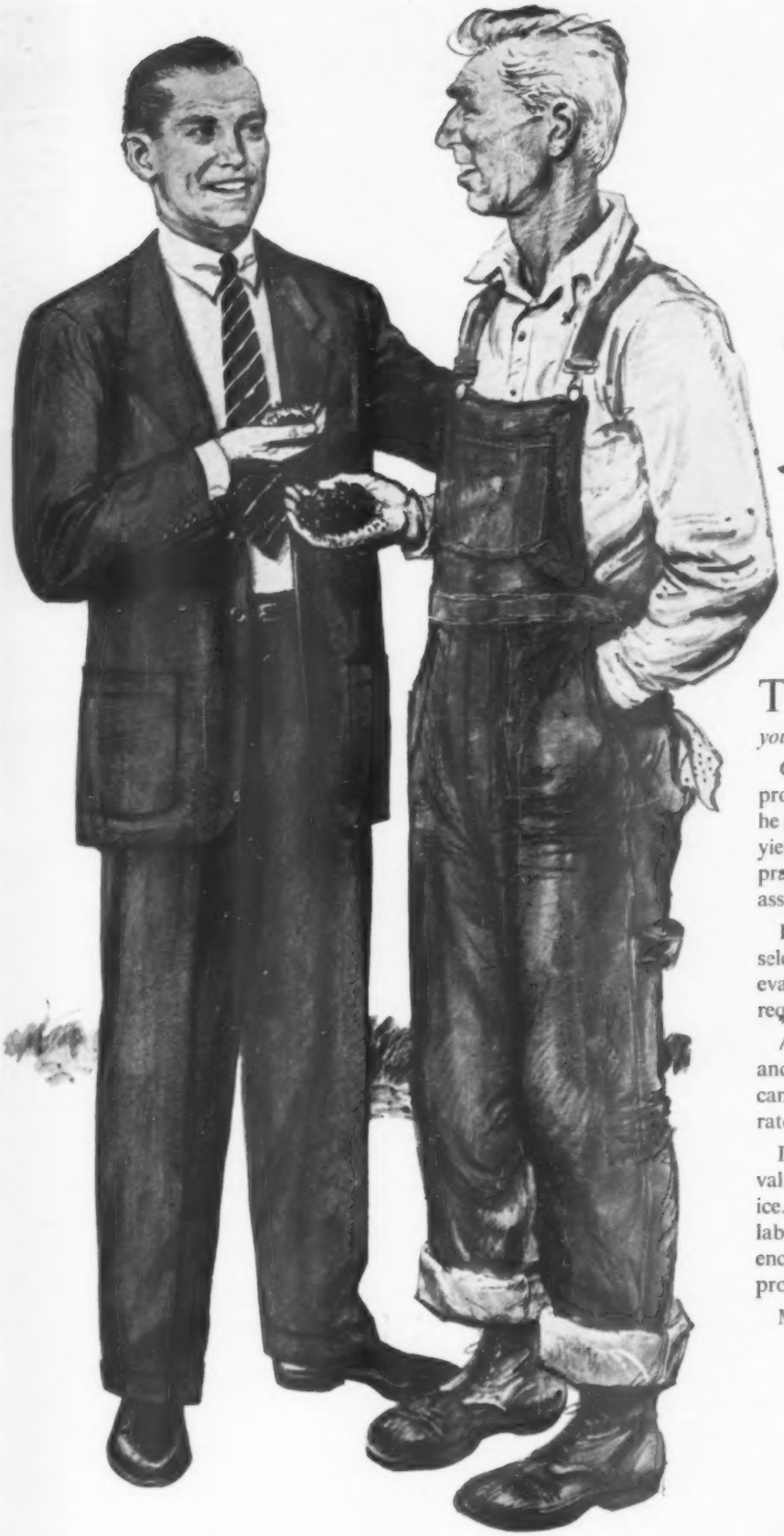

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CONTENTS

FACTORS INFLUENCING THE QUALITY OF TOMATO PRODUCTS. I. SURFACE-LOCALIZED PECTIC ENZYMES INACTIVATED BY BLANCHING. R. J. McColloch, George J. Keller, and E. A. Beavens 197

PEANUT BUTTER. II. EFFECT OF ROASTING AND BLANCHING ON THE THIAMINE CONTENT OF PEANUT BUTTER. R. K. Willich, M. D. Murray, R. T. O'Connor, and A. F. Freeman 199

ATOMIZATION AS A FACTOR AFFECTING QUALITY IN SPRAY-DRIED ALBUMEN. Dwight H. Bergquist and George F. STEWART 201

RADIO FREQUENCY AS A MEANS OF GRADING EGGS. K. H. Norris and A. W. Brant 204

THE DARKENING OF MARASCHINO AND GLACÉ CHERRIES. Peter Butland 208

RECOVERY OF FRUIT ESSENCES IN PRESERVE MANUFACTURE. G. W. MacPherson Phillips, Roderick K. Eskew, Nicholas C. Aceto, and John J. Skalamera 210

RELATIVE COLOR EVALUATION OF FOOD PUREES USING BLACK AND WHITE PHOTOGRAPHY. Dave Eolkin 214

THE NON-MICROBIAL NATURE OF THE BLACK SPOTS ON ICE-PACKED SHRIMP. John A. Alford and E. A. Fieger . . . 217

TECHNIQUES FOR ESTIMATING THE STABILITY OF FOOD PRODUCTS: ACTIVE DRY YEAST. John C. Crane, Harold K. Steele, and Sutton Redfern 220

EFFECT OF ANTIBIOTICS IN RETARDING THE GROWTH OF MICROCOCCUS PYOGENES VAR. AUREUS IN CUSTARD FILLINGS. W. J. Godkin and W. H. Cathcart 224

PREPARATION OF FULL-FLAVORED APPLE JUICE WITH INCREASED RESISTANCE TO FERMENTATION. C. R. Marshall and A. C. Walklin 229

BOOK REVIEW 234

NOTES AND LETTERS 236

NEWS OF THE INSTITUTE *8*

SELECTED ABSTRACTS *18*

Authors of papers intended for publication in FOOD TECHNOLOGY should request from the editorial office a copy of the booklet, entitled "Information and suggestions to authors." Manuscripts submitted for publication in FOOD TECHNOLOGY should follow the style described in this booklet.

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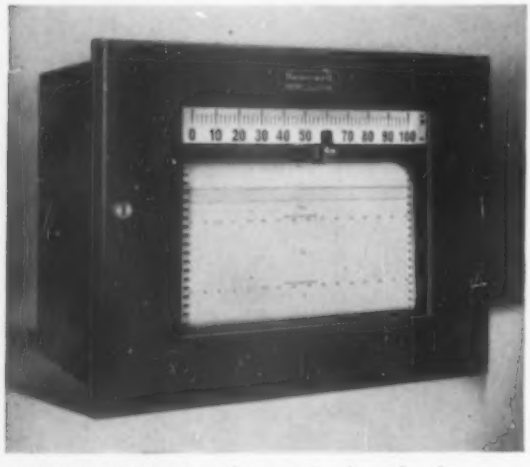

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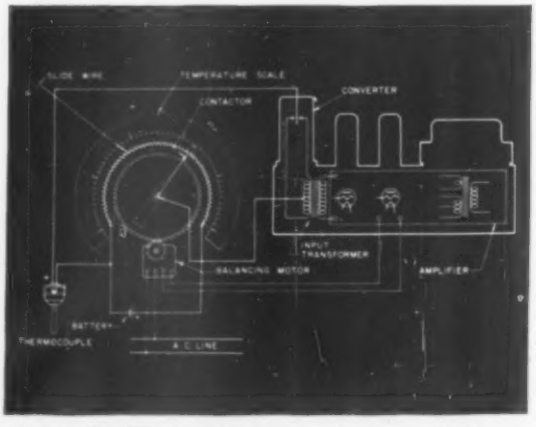

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pH Control: provides truly automatic, *continuous* neutralization of cream.

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Density control: invaluable in processing of liquid sugar to constant Brix value, and in many other applications.

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Fred Wilbur Tanner, 1952 Babcock Award Recipient

Fred Wilbur Tanner

Fred Wilbur Tanner is the 1952 winner of the Babcock Award of the Institute of Food Technologists.

Born in Buffalo, New York, he obtained his bachelor's degree at Wesleyan University and his master's and doctoral degrees at the University of Illinois. In 1943, Wesleyan University honored him with the honorary D.S. In 1915, Dr. Tanner began his long and distinguished teaching career in the Department of Bacteriology at the University of Illinois advancing in academic rank to Head of the Department in 1925. For twenty-four years, Dr. Tanner filled this position with distinction. He retired in 1950 due to ill health. He was Editor-in-Chief of *Food Research* during the fifteen years from 1936 to 1950.

Dr. Tanner's publications number at least 150, mostly in the fields of microbiology and public health. In addition to fundamental problems in pure bacteriology, Dr. Tanner and his students have carried out many important investigations in various phases of the food field. As early as 1922, he published a paper on the sanitary conditions of confections in which study he did not find *B. coli* present but that spore formers predominate. In this study he made the interesting and early observation that both cinnamon and peppermint exert repressive action on micro-organisms. In 1925, he carried out a careful study which indicated that members of the colon typhoid group in milk are destroyed by pasteurizing for 30 minutes at 140° F. As early as 1923, he studied the action of ultra-violet light on yeast-like fungi and showed that yeast cells are destroyed quite as readily as are bacteria. Naturally, as a bacteriologist and food technologist, he early became interested in studies in *Clostridium botulinum*. In one of these papers dealing with frozen foods, he reached the conclusion that if properly frozen and kept frozen, frozen foods are probably as safe and satisfactory as fresh foods. In collaboration with Wilson and Lueck of the American Can Company, an important paper was published on paper milk bottles. The results of this study indicated that the processing of pulp to make containers yields a paper board of low bacteriological content and that paraffining further reduces the bacteriological content.

In 1937, he and his co-workers studied three groups of thermophyllic spoilage organisms (flat sour, thermophilic anaerobes and sulphide spoilage thermophiles) as present in commercial sucrose used for canning. Some of these spoilage organisms were also found in starch. Later he and one of his students continued his earlier work by studying the effect of spices and flavorings on the growth of yeast. He also published an interesting study on the behavior of pathogenic bacteria in fermented milks. One of his last published reports was on the relation of certain cooking procedures to staphylococcus food poisoning. His last published scientific paper dealt with the public health aspects of paper and paper board in the food industry.

In addition to his work as an editor and researcher, he is the author of a number of outstanding texts which are widely used in the training of bacteriologists and food microbiologists. His first book, "Bacteriology and Mycology of Foods" was published in 1919. "Microbiology of Foods" was first published in 1932 and a second edition in 1944. A third revised edition is now in preparation. His "Bacteriology, a Textbook of Microorganisms" has passed through four editions, the fourth of which appeared in 1948. In 1933 "Foodborne Infections and Intoxications" was published by The Garrard Press. In the same year, "Practical Bacteriology, and Introduction to Bacteriological Techniques" appeared in its second edition, the first edition having been published in 1928. In 1950, Dr. Tanner made available his latest book "Laboratory Manual and Workbook in Microbiology of Foods."

An inspiring teacher, careful investigator and fine writer, Dr. Tanner has made outstanding contributions to public health through his studies in the field of microbiology of foods. A man of sound judgment, impressive personality, and a convincing speaker, his career has been a constant force for better foods. In the training of men and women to develop new knowledge of foods, his influence has been felt in making our American way of life what it is today. He is a Charter Member of the Institute of Food Technologists and served as its President in 1946-1947.

We salute and honor the 1952 Babcock Award winner, Dr. Fred Wilbur Tanner.

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News of the Institute

RESULTS OF IFT NATIONAL OFFICERS' ELECTION ANNOUNCED

The Tellers' Committee has completed counting the ballots in the annual election of officers for 1952-53. The election results are as follows:

For President-Elect: Berton S. Clark, Scientific Director, American Can Company, Maywood, Illinois.

For Councilors-at-Large: H. C. Diehl, George F. Garnatz, Louis B. Howard, Walter A. Maclinn, and Harold S. Mitchell.

Bernard E. Proctor, President-Elect during 1951-52 will be President during the year 1952-53.

MONSANTO PRESENTATION AWARD COMMITTEE APPOINTED

As noted in the April issue of FOOD TECHNOLOGY, appendix page 4, the Monsanto Chemical Company offered four successive annual awards of $100.00 each to be presented by the IFT at its Annual Meetings for the papers which are best presented.

The 1952 Monsanto Presentation Award Committee has been now appointed. The Chairman of the Committee is Philip K. Bates, while other members are Basil W. Clarke, an Associate Editor of FOOD TECHNOLOGY, and C. Olin Ball, Editor Emeritus of FOOD TECHNOLOGY.

The procedures to be used for the selection are being worked out now and will be ready for the Grand Rapids Meeting.

Regional Section News

MARYLAND SECTION

The section's March meeting, held at the Hotel Stafford, Baltimore, Md., resulted in a record turnout for this section of one hundred and forty people to hear Dr. Bernard E. Proctor, President-Elect of IFT, speak on "Recent Progress in Sterilization of Food Products by Radiation." The section was pleased to have as its guests the members of the Student Chapter, IFT, University of Maryland. Having these young food technologists as guests of the section has become an annual affair and is carried out in the hope of stimulating a lasting interest in IFT on the part of the students. The section was also pleased to play host to guests from the Tri-State Packers Association, meeting in Baltimore the same day. The United Company, Westminster, Md., through its contribution of cream style corn and the Southern Packing Company, Baltimore, Md., through its contribution of frozen peaches helped make the dinner that much more enjoyable.

The annual "Ladies Night" dinner meeting, delayed from December by the record storm at that time, was held at the Hotel Stafford, Baltimore, Md., on April 20th. Dr. Amihud Kramer, Department of Horiculture, University of Maryland, Past President of the Section, spoke on "Standardization—For Better or For Worse." Cocktails were enjoyed before dinner with a bottle each of Crosse and Blackwell's Martinis and Manhattans going as door prizes. Dessert consisted of cherry pie baked with cherries contributed by the C. H. Musselman Co. of Biglerville, Pa. Those attending the meeting served as a judging panel for several samples of frozen peas submitted by the Department of Horticulture, University of Maryland. Effect of the cocktails on the ability of the judges to score discriminately has not been ascertained.

PHILADELPHIA SECTION

The Section's April meeting was held on April 17th at the Whittier Hotel, Philadelphia, Pa. Speaker for the occasion was Dr. George R. Greenbank, Chemist, Bureau of Dairy Industry, U. S. Department of Agriculture, who spoke on "The Oxidation of Edible Fats and Oils and its Control." Dr. Greenbank is the author of fifty technical papers on fats and oils and in 1949 received the Borden Award for his work on the oxidation of butterfat and the flavor of milk. In 1950 he received the Superior Service Award from the U. S. Department of Agriculture.

GREAT LAKES SECTION

The Section held its spring meeting on April 25th at the Pantlind Hotel, Grand Rapids, Mich. A dinner meeting for all chairmen of committees and the treasurer for the annual meeting preceded on April 24th. The morning of April 25th was devoted to sessions of the committees for the annual meeting. An Executive Committee luncheon was held at noon. The afternoon was devoted to a section business meeting (including a tour of furniture exhibit for wives who will act as guides during the National IFT Annual Meeting in June), following which a discussion of committee chairmen was held to settle final details on the annual meeting. The evening dinner speaker was Dr. Bob Wilson, Head of the Food Inspection Department of the city of Detroit.

WESTERN NEW YORK SECTION

The Section's annual spring meeting was held on May 2 at Cutler Union, Women's Campus, University of Rochester, Rochester, N. Y. During the afternoon the following papers were given:

"The Use of Glass Piping in the Food Industries," by Dr. R. E. Holland, Department of Dairy Industry, Cornell University, Ithaca, N. Y.

"Chocolate Processing," by Mr. A. Amsler, Suchard of Canada, Ltd., Toronto, Can.

"The Cleaning, Handling, and Storage of Eggs," by Dr. J. C. Huttar, Co-operative Grange League Federation, Ithaca, N. Y.

"Controlling Quality in the Brewing Industry" by Mr. William Kazanjian, Iroquois Brewing Co., Buffalo, N. Y.

The evening dinner speaker was Dr. B. H. Webb, National Dairy Research Laboratory, Oakdale, Long Island, N. Y. Dr. Webb was formerly Principal Dairy Manufacturing Technologist, Bureau of Dairy Industry, United States Department of Agriculture. In 1943 he was presented with the Borden Award in Dairy Manufacturing from the American Dairy Science As-

(Continued on page 12)

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News of the Institute

(Continued from page 8)

sociation and in 1948 won the Superior Service Award by the U.S.D.A.

The Section's Buffalo area meeting was held on May 5th. Prior to the dinner at the New York State Institute of Applied Arts and Sciences in Buffalo, the group was taken on a tour of the Merckens Chocolate Company. This event took the form of a joint meeting with the Buffalo Section of the American Association of Cereal Chemists.

NORTHERN CALIFORNIA SECTION

The Section held its April meeting on the 17th at the University of California, Davis, Calif. During the afternoon tours were conducted through various divisions of the University, including Pomology, Truck Crops, Dairy Division, Enology, Poultry Husbandry and Food Technology. Following the tours a Wine Symposium was held in the Division of Food Technology. Dr. Stanley B. Freeborn, acting dean of the College of Agriculture, University of California, was the after-dinner speaker. The dinner was served in the pilot plant of the Division of Food Technology.

The Section's annual picnic is slated to be held on June 21st at the old Hearst Ranch in southern Alameda County.

The Delta Sub-section reports that it is to hold its first meeting in the Steak and Stein Restaurant, Sacramento, California, on May 21st. Dr. Karl F. Meyer, Director of the Hooper Foundation, is to be the speaker.

NORTHEAST SECTION

The Section's annual spring meeting was held on May 3rd at the University of Massachusetts, Amherst, Mass., taking place in Skinner Hall of the Home Economics Department. The afternoon session had a brief preliminary business meeting after which the group was addressed by Robert G. Neubauer, a well-known package design consultant, who operates the R. G. Neubauer, Inc. agency, with a studio located in Bridgeport, Conn. Mr. Neubauer took as his subject "Package Design—Silent Salesman." Incidentally it is worth noting that Mr. Neubauer has been three times winner of Modern Packaging All-American Awards, and is a member of the Packaging Institute. Following Mr. Neubauer's address, two brand new movies, "Your State University" and "Your Valley—Your Future" were shown. This excellent afternoon program, which concluded with a luncheon served at four o'clock, was organized by the Carl R. Fellers Student Chapter IFT of the University of Massachusetts.

The nominees presented at the April 3rd meeting for officers of the Northeast Section for the year June 1952 to May 1953 were unanimously elected and are as follows:

Chairman: J. Avery Dunn, Atlantic Gelatin Division, General Foods Corporation, Woburn, Mass.

Chairman-elect: James Donovan, Artisan Metal Products Inc., Waltham, Mass.

Secretary: Charles H. Shackelford, National Fish Dept., The Great Atlantic and Pacific Tea Co., New York, N. Y.

Treasurer: Ernest E. Lockhart, Food Chemistry Department, Massachusetts Institute of Technology, Cambridge, Mass.

National Councilors: Matthew E. Highlands, Maine Agriculture Experimental Station, University of Maine, Orono, Me.; Arthur S. Levine, Food Technology Department, University of Massachusetts, Amherst, Mass.

Section Councilors: Earl P. McFee, Gorton-Pew Fisheries Co. Ltd., Gloucester, Mass.; W. Leverett Cummings, W. L. Cummings & Co., Newton Centre, Mass.; Mary Harrigan, U. S. Food and Drug Administration, Boston, Mass.; Lawrence B. Abare, First National Stores, Inc., Somerville, Mass.

Retiring Chairman: Loren B. Sjostrom, Food Research Dept., Arthur D. Little Inc., Cambridge, Mass.

It might be of interest to report here that the membership present at the April 3rd meeting voted unanimously to empower its Executive Committee to incorporate the Northeast Section under the Laws of the Commonwealth of Massachusetts.

CHICAGO SECTION

On April 21, the Section held a meeting during which Dr. Franklin C. Bing, a consultant to the Delaney Committee, reviewed the subject of "Chemicals in Foods." His review consisted of three parts, the first of which was a definition of the problem, the second a review of what has been done, and the third was concerned with the future outlook.

PERSONNEL

S. L. Flugge, Director of Metal Container Research, Research Division of Continental Can Company, Chicago, Ill., addressed the April 14 meeting of the Pittsburgh, Pa. branch of the Association of Iron and Steel Engineers on the subject, "Plate Qualities Required in Can Manufacture."

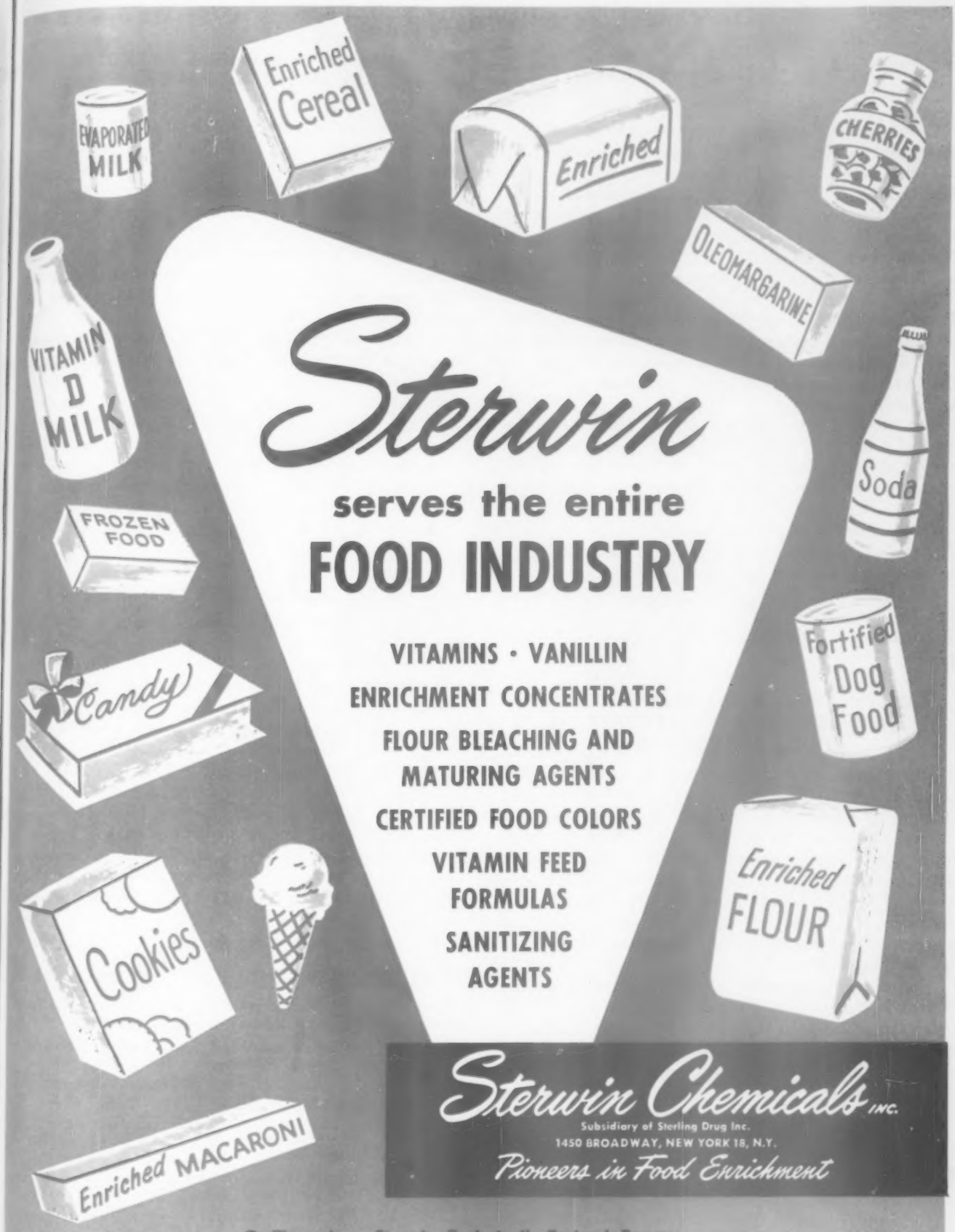
Nathan G. Fox, formerly Chief Chemist for College Inn Food Products Co., Chicago, Ill., is becoming Director of Research for Chun-King Sales, Inc., Duluth, Minn. Andrew J. Ward, formerly Assistant Chief, will become Chief Chemist at College Inn.

Samuel A. Goldblith has been appointed to the rank of Assistant Professor in the Food Technology Division of the Massachusetts Institute of Technology at Cambridge, Mass. Dr. Goldblith has been previously a Research Associate in the same Division.

Lloyd A. Hall, Technical Director of The Griffith Laboratories, Inc., Chicago, Illinois, and a national IFT Councillor, received an Achievement Award from the Phi Beta Sigma Fraternity at an Industry Conference at the U. S. Department of Commerce, Washington, D. C., April 19, 1952. Dr. Hall was cited among other things "for his long, constructive, and outstanding work in food chemistry." He has been with The Griffith Laboratories since 1929. Dr. Hall recently spent a few days lecturing at the University of California, Davis.

Morris H. Katz, formerly Assistant Research Director for Orange Crush Co., Chicago, Ill., has become Manufacturing Superintendent for B. A. Railton Co., Chicago, Ill.

(Continued on page 14)



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News of the Institute

(Continued from page 12)

CHARLES W. KAUFMAN, Executive Director of Research for the Kraft Foods Company of Glenview, Ill., has been named a Vice President of the company. Before coming to Kraft Foods, Mr. Kaufman was Director of Research of the General Foods Corporation at Hoboken, N. J. He held previous positions with the National Fruit Products Co. of Winchester, Va., and the National Canners Association in Washington, D. C.

ROMEO R. LEGAULT has been appointed Professor of Food Technology in the University of Illinois College of Agriculture at Urbana, Ill. Before coming to Illinois, Dr. Legault headed the Fruit Processing Division of the Western Regional Research Laboratory, USDA, at Albany, California.

ERNEST E. LOCKHART has been appointed from the rank of Assistant Professor to that of Associate Professor in the Department of Food Technology at the Massachusetts Institute of Technology, Cambridge, Mass.

C. E. NORTON, of the Continental Can Co., Chicago, Ill., recently returned from Caracas, Venezuela, where he visited a number of food processing plants.

W. E. PEARCE, the American Can Co., Chicago, Ill., has been appointed to the Processing Committee on Foods in Metal Containers, National Canners Association.

GORDON RESEARCH CONFERENCES TO DISCUSS TOPICS OF INTEREST TO FOOD TECHNOLOGISTS

At the Food and Nutrition Sessions of the 1952 Gordon Research Conferences, AAAS, to be held at Colby Junior College at New London, N. H., August 4-8, several discussions will be of interest to those concerned with foods. The Conference will open with a full-day session on fats and oils in which their stability, the synthesis of fats by interesterification, the role of fats in nutrition, the nutritional significance of rancidity, and the use of fat emulsions in intravenous alimentation will be discussed.

Half-day sessions each will be devoted to protein nutrition, fluorine and fluoridation, enzymes, and the interrelation between the endocrine system and nutritional processes. The conference on food standards and regulations will be particularly timely in view of the present interest in the use of chemicals in foods and in government food regulations in general.

There will be also a symposium dealing with food and feed production through the culture of microorganisms, and a session on infant food and infant feeding.

The full program of the Conferences was published in the April 7 issue of *Chemical and Engineering News* and in the April 11 issue of *Science*. Those interested to attend should apply to Dr. W. George Parks, Director, Gordon Research Conferences, Rhode Island State College, Kingston, R. I. The attendance is limited to 100 participants. Z. I. Kertesz is chairman and Bacon Chow vice-chairman of the 1952 Food and Nutrition Sessions.

WATER IN ALCOHOL DETECTED BY BLOTTING PAPER

Small quantities of water in alcohol can be detected merely by putting some alcohol on a specially treated strip of blotting paper. This new and delicate chromatograph test developed by Dr. J. E. Stringer of Vickers-Amstrongs, Newcastle-on-Tyne, England, and reported to the journal Nature, is expected to determine from one-tenth to one-half per cent of water in alcohol used for chemical purposes. Unlike beverage alcohol, that used for chemical work should contain little water and it is often desired to know just how much water is present.

The alcohol being tested is allowed to soak up through a strip of blotting paper which is impregnated with two chemicals. The alcohol first reaches a zone of iron sulfate, which is dissolved in the water and not in the alcohol. When this salt, picked up by the water, reaches the area containing potassium ferricyanide, a blue coloration consisting of ferric ferrocyanide is produced. The extent and intensity of the coloration depends upon the amount of water present. [From *Aminco Lab. News*, **8** (6) 2 (1951) September.]

SCRAP IS EVERYWHERE

Scrap iron and steel are much needed by the U. S. production program. The iron and steel scrap program was originally organized to flush out all "obvious" dormant scrap from known sources. Now the efforts of some enterprises and imaginative sleuths are turning up scrap in the darndest places. Gimbels in Philadelphia combed their shops and came up with 450 tons of scrap, five Hollywood movie studios dug up a hundred tons, Western Union in the Atlanta region found 17,000 feet of copper tubing, a small plant in Galion, Ohio, unearthed 200 tons, and a small town garage in Somerville, Tennessee, found it had 50 tons. These scrap mines above the ground are everywhere and should be utilized in order to maintain iron and steel production goals.

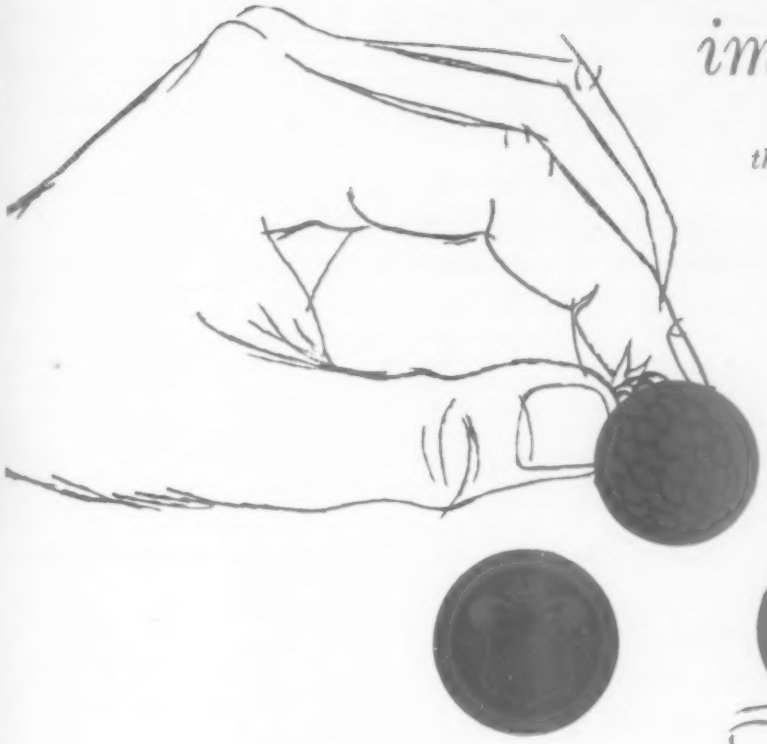
FUTURE DATES FOR FOOD TECHNOLOGISTS

June 8-12	**Institute of Food Technologists, Twelfth Annual Meeting, Grand Rapids, Mich.**
June 19-22	American Plant Food Council, Annual Meeting, The Homestead, Hot Springs, Va.
June 24-26	American Dairy Science Association, Annual Meeting, Davis, Calif.
July 2-4	Annual Convention, Australian Section, IFT, Hawkesbury Agricultural College, Richmond, N. S. W.
August 4-8	Food and Nutrition sessions, Gordon Research Conferences, AAAS, New London, N. H.
Sept. 9-13	Seventh National Chemical Exposition, ACS, Coliseum, Chicago, Ill.
Sept. 29-Oct. 1	Association of Official Agricultural Chemists, Annual Meeting, Shoreham Hotel, Washington, D. C.
Oct. 20-22	Fall Meeting, American Oil Chemists' Society, Cincinnati, Ohio.

(Information concerning future dates of national and international meetings, conventions and exhibits of interest to food technologists should be sent to the editorial office.)

Which

one is the imitation?



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Selected Abstracts[a]

ANALYTICAL METHODS

Analytical standardization within a petroleum company.

TUEMMLER, F. D. *Anal. Chem., 23,* 1559 (1951).

Analytical standardization is a productive force toward improved testing practices only when those for whom it is intended are participants in, and have responsibility for, the standardization program. In the U. S. A. this is attempted by the Shell group of companies and the effectiveness of the plan can be judged from the extent of utility of the Shell method series, the multivolume collection of test methods prepd. under such a program.

The analytical determination of mineral oil in bread and buns: the effect of varying composition of these baked goods on mineral oil absorption.

COOKSON, M. A., AND COPPOCK, J. B. M. *J. Sci. Food Agr., 2,* 434 (1951).

A method is described for the detn. of mineral oil in com. bread, which might contain added gluten and/or fat malt breads and buns. The variation in compn. of these products influences the relative quantities of mineral oil absorbed by each, and also the quantities capable of solvent extn. under the standard conditions described. Complete extn. of mineral oil from such products is difficult to achieve, but the ratio of mineral oil to the natural oils present in the ext. obtained by solvent extn. under standard conditions is const. Analytical results obtained with various types of bread and buns adulterated with known quantities of mineral oil permit correlation with the quantity of such oil extd. from unknown samples by the described method. This procedure is reasonably satisfactory for all the above products except malt breads.

The protein and non-protein nitrogen fractions in milk. I. Methods of analysis.

SHAHANI, K. M., AND SOMMER, H. H. *J. Dairy Sci., 34,* 1003 (1951).

Methods have been described for detn. of total nitrogen, casein, albumin, globulin, proteoses-peptones, non-protein nitrogen, ammonia, urea, creatinine, creatine, uric acid, and *alpha*-amino nitrogen in milk. Bulk milk samples were analyzed fresh and after holding at 0° to 5° C. for 10 days (toluene preserved). No significant change was observed in the nitrogen distribution during this aging.

Analysis of chlorophyll.

Mfg. Chemist, 22, 490 (1951).

Methods used at British Chlorophyll Co. Ltd. for (1) calcg. color strength and ratio of chlorophyll, and (2) estg. percentage of chlorophyll, are described.

Corn sirup analysis by selective adsorption.

Natl. Bur. Standards (U. S.) Tech. News Bull., 35, 163 (1951).

The National Bureau of Standards method for the detn. of dextrose, maltose and dextrin fractions makes use of the selective properties of carbon adsorbents. A glass column is filled with equal wts. of the carbon adsorbent (Darco 60, analytical grade) and a diatomaceous earth filler (Celite). The top of the tube is coupled to a nitrogen tank, so that 30 to 50 pounds pressure can be applied to increase the rate of flow of liquid through the adsorbent. The sample to be analyzed is added and allowed to penetrate the column. A 1-liter portion of water is passed through under pressure. The water removes the dextrose but none of the maltose or dextrins. The washing is repeated, with a liter of 5% ethyl alc.; this removes the maltose, leaving the dextrins. The dextrins are removed with a liter of 15% ethyl alc. The column is then cleaned with 95% alc. and washed with water; this removes all traces of carbohydrates and leaves the app. ready for the next run. The whole sepn. can be accomplished in about 1½ hours. Each of the 3 washings is then evapd. under diminished pressure to a volume that can be made up to 100 ml. The dextrose and maltose fractions are analyzed quantitatively either by polarization or by one of the accepted chem. procedures. The dextrin fraction, consisting of a mixt. of polydextrose molecules, is reported in terms of its dextrose equivalent.

Polarographic determination of tartrates in wines.

MATHERS, A. P., BECK, J. E., AND SCHOENEMAN, R. L. *Anal. Chem., 23,* 1767 (1951).

Tartaric acid is quantitatively pptd. and interfering substances are removed from wine by the procedure presented. A tartaric acid-antimony complex may be polarographed and a characteristic reduction wave obtained for use in quant. work. Tartaric acid was found only in wines derived from grapes. The scope of the polarographic method is broadened by showing measurement of ions which in themselves are not reducible under conditions ordinarily employed in polarographic work. Most α-hydroxy acids can be detd. from suitable complexes. There may be application to certain acids produced in metabolic processes.

The determination of micro quantities of isopropyl N-phenylcarbamate (IPC) in head lettuce.

BISSINGER, W. E., AND FREDENBURG, R. H. *J. Assoc. Offic. Agr. Chemists, 34,* 812 (1951).

The herbicide is extd. with methylene dichloride. After evaporating the solvent, it is hydrolyzed in acid soln. The aniline produced is removed by steam distn. from alk. soln. and detd. by the hypochlorite-phenol method.

Determination of dithiocarbamate residues on food crops.

LOWEN, W. K. *Anal. Chem., 23,* 1846-50 (1951).

The conventional Dickinson-Viles technic for detg. micro quantities of dithiocarbamates was modified to permit the detn. of less than 1 p.p.m. of ferric dimethyldithiocarbamate, zinc dimethyldithiocarbamate, and zinc ethylenebis (dithiocarbamate) residues on orchard and garden products. The residues of these fungicides on celery, tomatoes, cherries, cabbage, and green beans were greatly reduced by allowing several days between final treatment and harvest, and by washing or canning. Of significance to growers and processors of fruits and vegetables is the fact that no measurable build up of dithiocarbamate residues was encountered as frequency and number of treatments were increased in order to afford protection during long growing seasons.

Determination of DDT residues on corn.

FAHEY, J. E., AND RUSK, H. W. *Anal. Chem., 23,* 1826 (1951).

A rapid, accurate, and precise technic is described for the detn. of DDT residues on corn plants by the Stiff-Castillo method. It would be equally applicable to routine detn. of DDT residues on other plants which give residue solns. similar to those obtained from corn plants.

Chromatographic determination of the acids of the citric acid cycle in tissues.

GROHMAN, C. E., ORTEN, J. M., AND SMITH, A. H. *J. Biol. Chem., 193,* 277 (1951).

A procedure for the sepn. and simultaneous quant. detn. of fumaric, α-keto-glutaric, oxalacetic, succinic, lactic, pyruvic, malic, *cis*-aconitic, isocitric, and citric acids in animal tissues by partition chromatography on silica gel is presented. The method has been employed satisfactorily for detg. amts. of total acids varying from approx. 1 to 15 mg. per sample of tissues.

(Continued on page 26 following technical papers)

[a] These Selected Abstracts are made available to FOOD TECHNOLOGY through the cooperation of Associate Editor H. A. Campbell and the General Foods Corporation of New York, N. Y. The abbreviations found in these abstracts are similar to those used by Chemical Abstracts.

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Abstracts

(Continued from page 18 preceding technical papers)

Use of paper chromatography for the quantitative estimation of quercetin in rutin.

NAGHSKI, J., FENSKE, JR., C. S., AND COUCH, J. F. *J. Am. Pharm. Assoc., Sci. Ed., 40,* 613 (1951).

A method has been developed for the specific detn. of quercetin in rutin prepns. It is not subject to error due to interfering substances, and is not critical as to standardization of wave length and prepn. of sample.

The chromatographic identification of some biologically important phosphate esters.

BANDURSKI, R. S., AND AXELROD, B. *J. Biol. Chem., 193,* 405 (1951).

A two dimensional chromatographic method for the identification of some phosphate esters of biol. importance, including inorg. poly-phosphates, is described. An acid solvent consisting of methanol, formic acid, and water and a basic solvent contg. methanol, ammonia, and water are used. An improved method of color development involving ultraviolet light permits the hydrolysis of resistant esters and the minimization of background color.

Identification of flavonoid compounds by filter paper chromatography.

GAGE, T. B., DOUGLASS, C. D., AND WENDER, S. H. *Anal. Chem., 23,* 1582 (1951).

The recent use of flavonoid compds. in the treatment of radiation injury and frostbite has lent new emphasis to the need for improved methods of identifying these pigments. A particular need for micromethods of sepn. and identification of flavonoid pigments in plant exts. has prompted the application of paper partition chromatography methods to this problem. The paper chromatographic behavior of 38 flavonoid-type compds. has been detd. in 11 solvent systems. The visible and fluorescent colors produced by eight chromogenic sprays when applied to the developed chromatograms have been tabulated. The use of paper chromatography coupled with chromogenic sprays presents an addnl. tool for the classification and identification of flavonoids obtained from natural sources or by synthesis. The method is of particular advantage in evaluating the efficiency of various sepn. or purification procedures.

BIOLOGICAL SCIENCES

BIOCHEMISTRY

Histochemical demonstration of esterases by production of indigo.

BARRNETT, R. J., AND SELIGMAN, A. M. *Science, 114,* 579 (1951).

Both indoxyl acetate and indoxyl butyrate were used as substrates for esterases in tissue prepns. The indoxyl formed by the esterase activity is rapidly oxidized to indigo blue and pptd. from soln.

The fermentation-inhibiting properties of orange oil.

MOSSEL, D. A. A. *Nature, 168,* 999 (1951).

Orange oil and terpenes from orange oil possess antimicrobial properties. 0.01% inhibited the fermentation of *S. cerevisiae.*

A comparison of the chronic toxicities of synthetic sweetening agents.

FITZHUGH, O. G., NELSON, A. A., AND FRAWLEY, J. P. *J. Am. Pharm. Assoc., Sci. Ed., 40,* 583 (1951).

Data are given on the chronic oral toxicities of the synthetic sweetening agents, saccharin, sodium cyclohexyl sulfamate, dulcin, and P-4000. The results indicate that these four substances may be divided into a toxic group and a relatively nontoxic group. Dulcin and P-4000 were toxic to rats at dosage levels of 0.1% and above, whereas saccharin and sodium cyclohexyl sulfamate had only slight effects at a dosage level of 5%.

The synthesis of "Biologically Labile" methyl groups in the germ free rat.

DU VIGNEAUD, V., RESSLER, C., AND RACHELE, J. R. *J. Nutrition, 45,* 361 (1951).

A metabolic expt. with germ-free rats fed deuterium oxide has demonstrated that animals living in the complete absence of microorganisms are capable of synthesizing the labile methyl group as shown by the presence of deuterium in the methyl group of certain compds. such as tissue choline and creatine. The degree of synthesis was comparable to that observed in control multicontaminated rates. The methods of isolation of choline and creatine from tissues, the degradation of these compds., and the quantitative isotope detns. are presented.

MEDICINE

Action of propylene glycol upon experimental tuberculosis in guinea pigs.

BAZZICALUPO, C., PORTELLA, A., AND CONTIERI, M. *Proc. Soc. Exptl. Biol. Med., 78,* 671 (1951).

Subcutaneous treatment of infected guinea pigs with propylene glycol inhibits extensive tuberculosis alterations and prolongs survival time.

Sulfur aids wound healing.

Science News Letter, 60, 343 (1951).

Addn. of sulfur-contg. amino acids to the diet greatly speeds wound healing, even when an otherwise low protein diet is eaten. During the healing of a wound the sulfur compds. accumulate in the body, whereas proteins in general are lost by excretion faster than they are gained through diet. During the stress reaction after wounding, tissue protein is sacrificed to make a greater proportion of sulfur amino acids available for some process connected with healing.

Vitamins seen as future heart disease prescription.

Science News Letter, 60, 386 (1951).

The heart tissues utilization of foodstuffs is greatly impaired when the diet is lacking in any of the following vitamins: niacin, folic acid, pantothenic acid, biotin, and pyridoxine, as well as thiamin. Vitamins may prove useful in the therapy of certain types of heart disease.

Acclimatization to cold: natural and artificial.

SELLERS, E. A., REICHMAN, S., AND THOMAS, N. *Am. J. Physiol., 167,* 644 (1951).

Clipped, nonacclimatized rats exposed to 1.5° C., die of hypothermia within 24 hours. However, an increased rate of survival occurs if the animals are acclimatized to the cold for about 6 weeks prior to clipping or pretreated with a combination of cortisone and thyroxine. It was also shown that with clipped rats the rate of oxygen consumption is increased for longer periods if the animals were previously acclimatized.

NUTRITION

The effect of fat level of the diet on general nutrition.

GREENBERG, S. M., CALBERT, C. E., DEUEL, JR., H. J., AND BROWN, J. B. *J. Nutrition, 45,* 521 (1951).

Methyl arachidonate has been shown to have 3.5 times the biopotency of linoleic acid when fed to fat-deficient rats. The requirement of the male rat for linoleate was shown to exceed 100 mg. daily; in confirmation of earlier work, it has been demonstrated that the optimum level for female rats is considerably lower than that for male animals. The efficiency of utilization of the calories was increased progressively with increasing dosages of essential fatty acids; however, the highest efficiencies were obtained with the 30% fat diet. Greater efficiency of utilization of the calories was obtained in the males than in the females.

(Continued on page 28)

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Abstracts

(Continued from page 26)

The effect of fat level of the diet on general nutrition.

DEUEL, H. J., GREENBERG, S. N., ANISFIELD, L., AND MELNICK, D. *J. Nutrition, 45,* 535 (1951).

A biol. procedure for the detn. of essential fatty acids has been established. Good agreement was obtained between the analyses for essential fatty acids by bioassay and by spectrophotometry in the case of margarine oils, butters, cottonseed oil, and a shortening prepared by selective hydrogenation. In confirmation of earlier work, it has been found that the administration of hydrogenated coconut oil has a depressing effect on the growth of fats fed a fat low regimen, in proportion to the level fed; this depressing effect can be completely counteracted by adequate supplementation with linoleate. The optimum level of linoleate required by fat depleted male rats would seem to exceed 200 mg. per day. Apparently the requirement of essential fatty acids is increased with the concomitant ingestion of fat.

Heat damage to edible oils.

Nutrition Revs., 9, 326 (1951).

Nutritive values of fish and vegetable oils after heat treatments show significant decreases in body wt. Toxic factor produced in heat polymerization and destruction of essential metabolites are two possible explanations.

Amino acid content of processed meats.

SCHWIEGERT, B. S., BENNETT, B. A., MCBRIDE, B. H., AND GUTHNECK, B. T. *J. Am. Dietet. Assoc., 28,* 23 (1952).

The amts. of 18 amino acids in certain processed meats (sausage items, canned meats, cured meats, etc.) were detd. In general, these products were similar in amino acid composition to fresh and cooked beef, pork, and lamb samples. Head cheese and potted meat were low in several of the essential amino acids. A summary of the amts. of 18 amino acids in fresh and cooked beef, pork, and lamb and in the processed meats has been presented. The percentage of the total nitrogen accounted for by the 18 amino acids averaged 86.1 for all the samples studied.

Amino acid composition of fresh and cooked beef cuts.

GREENWOOD, D. A., KRAYBILL, H. R., AND SCHWEIGERT, B. S. *J. Biol. Chem., 193,* 23 (1951).

The percentages of the 18 amino acids found in the crude protein of different cuts and grades of beef were practically similar. However, cuts of utility beef gave higher percentages of the amino acids than choice cuts. The amino acids were found to be stable to cooking.

B-complex vitamins in meat.

WESTERMAN, B. D., VAIL, G. E., KALEN, J., STONE, M., AND MACKINTOSH, D. L. *J. Am. Dietet. Assoc., 28,* 49 (1952).

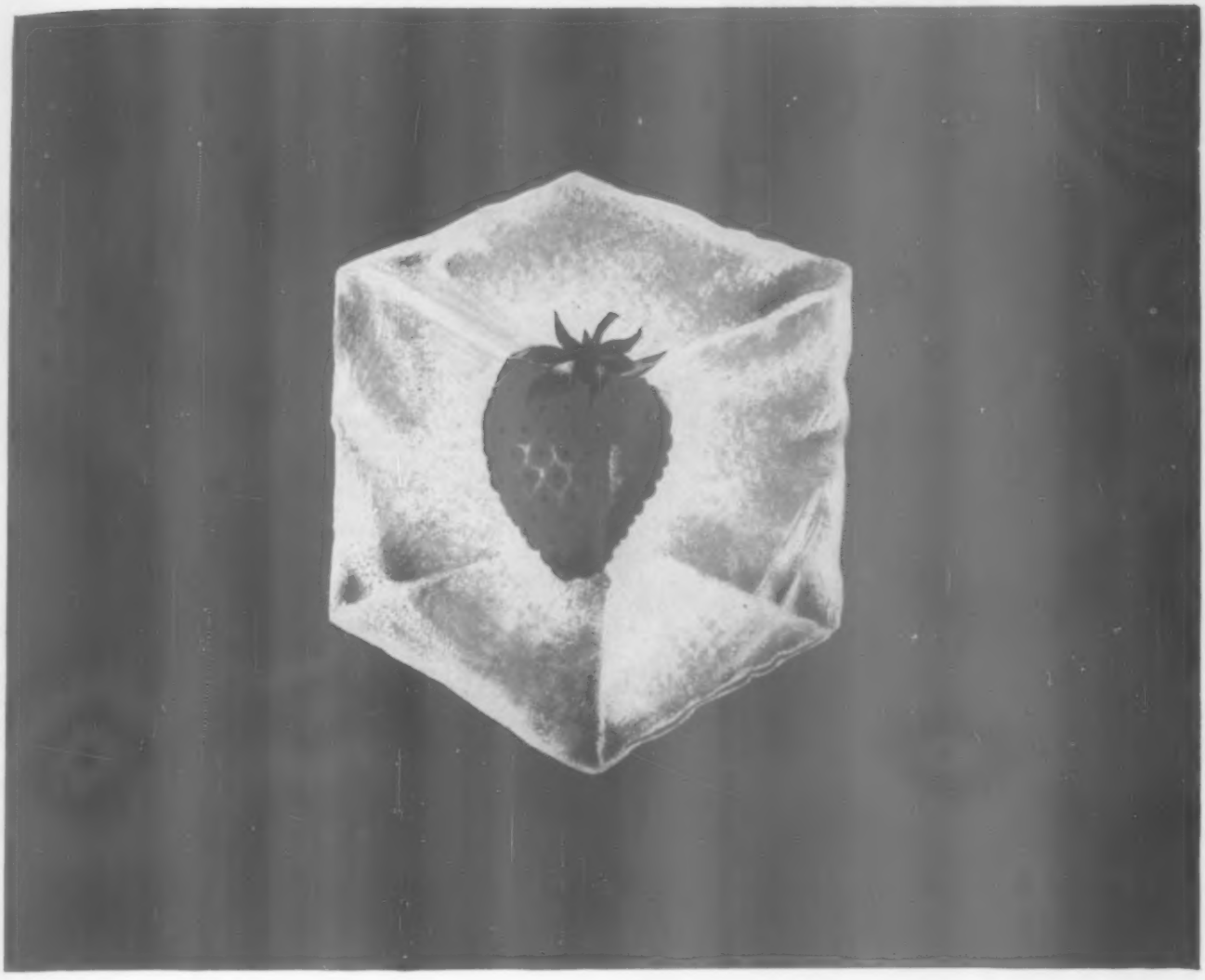
Two expts. have been conducted to det. the changes in the vitamin content of pork muscle after storage at different temps. and for different periods. The data show considerable animal variation in the vitamin content of the different samples. No outstanding losses of any of the vitamins studied could be attributed to storage time or temp.

Effect of glycerol-mono-stearate on fat absorption, growth and health of calves.

HUFF, J. S., WAUGH, R. K., AND WISE, G. H. *J. Dairy Sci., 34,* 1056 (1951).

Three groups of 5 calves each were fed from the colostral state to 6 weeks of age diets in which fat was dispersed by different means: Diet A consisted of the basal ingredients plus 3.5% hydrogenated cottonseed oil dispersed by homogenization; diet B, the basal plus 3.0% hydrogenated cottonseed oil dispersed by 0.5% emulsifying agent, glycerol-monostearate, and homogenization; and diet C was identical to diet B except that it was unhomogenized. At 4 and 6 weeks, the plasma fat of calves receiving diet B were significantly higher statistically at the 1% level than that of calves receiving diet A, whereas the plasma fat levels from diet C were intermediate, indicating that

(Continued on page 30)



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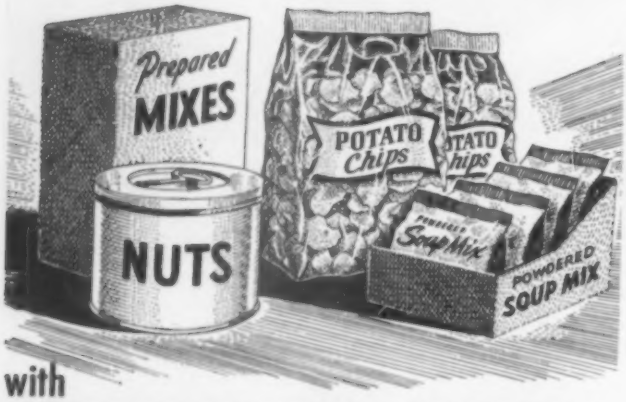

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Abstracts

(Continued from page 28)

glycerol-mono-stearate aided in absorption of lipides. Although the growth of calves fed diet A was somewhat better than that of calves fed either diet B or C, the differences in body wt. gains were not significant statistically.

Effect of frying bacon on the nutritive value of the protein.

McBride, B. H., Guthneck, B. T., Hoffert, E., Knickel, D., and Schweigert, B. S. *J. Nutrition, 45,* 393 (1951).

The effect on the nutritive value of the protein of bacon attributable to cooking was investigated. Lyophilized and ether-extd. bacon was fed as the sole source of protein at a 10% level in the diet to weanling rats. No reduction in the utilization of the protein by weanling rats was observed in 3 tests with crisp-fried (well done) bacon or in one test with limp-fried (medium-done) bacon as compared to control groups receiving uncooked bacon. A small reduction in the nutritive value of the protein, which was statistically significant, was observed for one test with crisp-fried bacon.

The metabolism of sorbitol.

Wick, A. N., Almen, M. C., and Joseph, J. *J. Am. Pharm. Assoc., 40,* 542 (1951).

The total oxidation of C^{14} labeled sorbitol over a 24 hour period approaches that of labeled glucose when given to fed normal rats. Sorbitol administered orally is oxidized at a much slower rate for the first 3 hours. The slower rate of oxidation was shown to be due chiefly to delayed intestinal absorption. C^{14} labeled sorbitol and glucose produce equal amts. of liver glycogen when given to fasted rats; the amt. of incorporation of C^{14} in the glycogen is the same with two compds. It is believed that the metabolism of sorbitol proceeds through glucose.

The utilization of dietary calcium by growing albino rats fed diets containing lard or cocoa butter.

Beadles, J. R., Mitchell, H. H., and Hamilton, T. S. *J. Nutrition, 45,* 399 (1951).

The comparative effect on calcium utilization of lard and of cocoa butter administered at a 20% dietary level, and of these diets as compared with a low-fat diet, was studied using 12 trios of young albino rats in a 42 day feeding period. The av. calcium utilization was 73.9 for the low-fat diet, 72.1 for the lard diet, and 57.6 for the cocoa butter diet. From measurements secured of the dry wt., calcium content, and heat of combustion of the feces produced on these three diets, it is evident that the inhibiting effect of cocoa butter on calcium utilization is largely, or entirely, accounted for by the greater formation of insol. calcium soaps.

Seek unknown nutrient.

Science News Letter, 60, 374 (1951).

Special feeding tests with rats suggest the presence of a new nutrient in butter and oleomargarine. Rats were fed diets adequate in all known nutrients but differing in their fat content. The fat was given as butter, butter-fat, oleomargarine, or oleofat. Offspring of mothers fed either the butterfat or oleofat only were more apt to die or weigh less at weaning than those from mothers who had always been fed on the butter and oleo diet. The nutritive property is thought to be in the milk solids present in both butter and oleomargarine.

FOOD PRODUCTS

BAKERY PRODUCTS

Staining methods for studying ingredient distribution in baked cakes.

Jooste, M. E., and Mackey, A. O. *Stain Technol., 27,* 17 (1952).

A method is described for prepg. cake crumb for sectioning and staining. Previous to embedding, the fat was stained and

(Continued on page 32)

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Abstracts

(Continued from page 30)

fixed by exposing small blocks of cake to the fumes from a 5%, freshly-prepd., aq. soln. of osmic acid (OsO_4). This was followed by dehydration in ethyl alc. and tertiary butyl alc., removal of air under vacuum and infiltration with paraffin. Sections were cut 20 and 30μ thick and mounted with water. Wax was removed by immersion in xylene. The sections were rehydrated in a series of ethyl alc. dilns., from concd. to dil., then transferred to distd. water. Protein was then stained pink by immersion of the slides in an acidified 0.04% water soln. of eosin Y, or starch was stained blue with a dil. aq. soln. of iodine. Ten g. iodine and 10 g. KI were dissolved in 25 ml. distd. water. This stock soln. was dild. for use one to two hundred times. The relationship between protein and starch was demonstrated by staining the sections with eosin, differentiating in 50% alc. and staining with iodine. When slides of cake crumb were prepd. in this way, the fat was stained black, the protein bright pink and the starch granules a dark blue.

COFFEE AND COCOA

Development of a new process for curing coffee.

JOHNSTON, W. R., AND FOOTE, H. E. *Coffee Tea Ind.*, *75*, 12, 1952.

Process comprises: Mech. removal of the skin and part of the pulp of the coffee cherries to yield "pulped beans." Pectic enzyme digestion at ambient temp. of the residual mucilaginous layer coating the pulped beans. Washing of the pulped beans to remove the digested mucilage. Mech. drying in 4 to 6 hours of the digested and washed pulped beans (beans in clean parchment). Hulling and grading by accepted methods.

The use of ion exchange resin for the hydrolysis of casein and coffee proteins.

UNDERWOOD, G. E., AND DEATHERAGE, F. E. *Science*, *115*, 95 (1952).

Casein was selected for exploratory expts. Accordingly, 3 g. casein, 15 g. 200-400 mesh Dowex-50, and 300 ml. water were mixed thoroughly and refluxed. The soln. gave a negative biuret reaction after about 70 hr. Boiling was continued for an addnl. 24 hr. to insure completion of the reaction. At the end of the hydrolysis, most of the amino acids were on the resin. By using barium hydroxide, all the amino acids were stripped from the resin. This barium hydroxide ext. was then treated with sulfuric acid to remove the barium and to give essentially a soln. of amino acids. The amino acids also may be fractionally removed by use of HCl or various buffers. The same procedure was found satisfactory for the hydrolysis of proteins from a sample of green Santos coffee.

Caffeine in cacao beans.

FORSYTH, W. G. C. *Nature*, *169*, 33 (1952).

A discussion is presented to det. if caffeine is present as a complex or in the free state in the cacao bean. Caffeine was always found in the free state.

FATS AND OILS

The branched chain fatty acids of butterfat. I. The isolation from butterfat of branched-chain fatty acids with special reference to the C_{15} acids.

HANSEN, R. P., AND SHORLAND, F. B. *Biochem. J.*, *50*, 207 (1951).

Branched long-chain fatty acids formerly unidentified in natural glycerides have been isolated from butterfat. Two C_{15} methyl branched-chain fatty acids, isomeric with normal heptadecanoic acid are shown to be present in butterfat. Based solely on the m.p. evidence of branched-chain fatty acids as presented by Cason (1948), one of the two C_{17} fatty acids isolated (m.p. 54.4° C.) appears to be the *iso* acid, while the other (m.p. 39.8° C.) appears to be the *anteiso* acid.

(Continued on page 34)

"Cuts pressing time 1/3 with help of CELITE"

A report on prune pressing by a Celite Field Engineer

"BEFORE USING CELITE* Pressing Aids, one of my customers was getting only two batches of prune juice per day from the presses. When he started mixing a small percentage of Celite with the cooked fruit, the saving in pressing time was apparent at once. Now he gets three batches per day.

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Glazes
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Abstracts

(Continued from page 32)

The antioxidant properties of natural spices.

CHIPAULT, J. R., MIZUNO, G. R., HAWKINS, J. M., AND LUNDBERG, W. O. *Food Research, 17,* 46 (1952).

The antioxidant properties of samples of 32 spices have been examd. With one exception in the 78 samples examd. (one sample of ginger) the ground spices in all cases exhibited an antioxidant effect on prime steam lard when tested by the active oxygen method at 98.6° C. (210° F.). Rosemary and sage exhibited particularly pronounced antioxidant effects. Petroleum ether sol. and alc. sol. fractions of these spices, with few exceptions, did not exhibit antioxygenic activities as marked as those of ground spices when employed at equivalent concns.

Dihydroquercetin as an antioxidant.

KURTH, E. F., AND CHAN, F. L. *J. Am. Oil Chemists' Soc., 28,* 433 (1951).

Dihydroquercetin, a white cryst. pentahydroxyflavanone, occurring in large quantities in Douglas fir and Jeffrey pine barks, was found to be an effective antioxidant for lard, cottonseed oil, and butter oil. This compd. imparts no taste and color to fats and oils and, like quercetin, appears to be nontoxic. It was found that 0.03% quercetin was slightly more effective than 0.03% dihydroquercetin as an inhibitor of rancidity in lard. The presence of a small amt. of citric acid increased markedly the antioxidant effect of dihydroquercetin on lard. The pentaacetate, pentapropionate, and the pentabenzoate esters of dihydroquercetin showed no antioxidant activity.

FISH PRODUCTS

Substantial savings in fish meal found in low temperature drying.

Pacific Fisherman, 49, 22, August, 1951; *Comm. Fisheries Abstracts, 4,* 17, November, 1951.

Although many low-temp. conversions were made primarily to combat-odor nuisance, such conversions are being made more and more for economic reasons. The essential problem in meal production is to manuf. the meal in such a manner that the protein and vitamins found in the raw material are not destroyed. It is now commonly accepted that a drying gas having a temp. above 650° F. causes destruction. Low temp. driers, which operate at a gas temp. usually below 600° F., definitely yield fish meal of higher protein value and with lower loss of material through burning and dusting.

Improvement of jelly for fish preserves.

LUDORFF, W., AND WINSCHE, G. *Deut. Lebensm. Rundschau, 47,* 161 (1951); *Brit. Abstracts, BIII,* 596 (1951).

A mixt. (1 : 1) of pectin having low ester value (from sugar beet) and gelatin is more palatable than is gelatin alone when used for jellying fish, and has greater setting power and resistance to heat $\geq 35°$ C. Pure pectin jelly is unaffected at $-20°$ C. but the mixt. does not withstand temp. $<5°$ C. much better than does gelatin. Full working details for using the mixt. are given.

MILK AND MILK PRODUCTS

Enzymes give quality to evaporated milk.

Science News Letter, 60, 328 (1951).

By slightly changing the structure of the milk protein molecules, the viscosity of evapd. milk can be doubled. Proteolytic enzymes are added in small amts. just before the milk is sterilized. Color and flavor are not affected by this change in the molecule.

The solubility of whole milk powder as affected by protein stabilizers and by emulsifiers.

HIBBS, R. A., AND ASHWORTH, U. S. *J Dairy Sci., 34,* 1084 (1951).

Na_2HPO_4 (0.2%) appears to be the best salt to use in stabilizing milk for drying as far as soly. is concerned. How-

(Continued on page 36)

Through new low-temperature essence recovery techniques, developed in our laboratories, Alva natural fruit flavors possess greater fidelity, freshness and strength.

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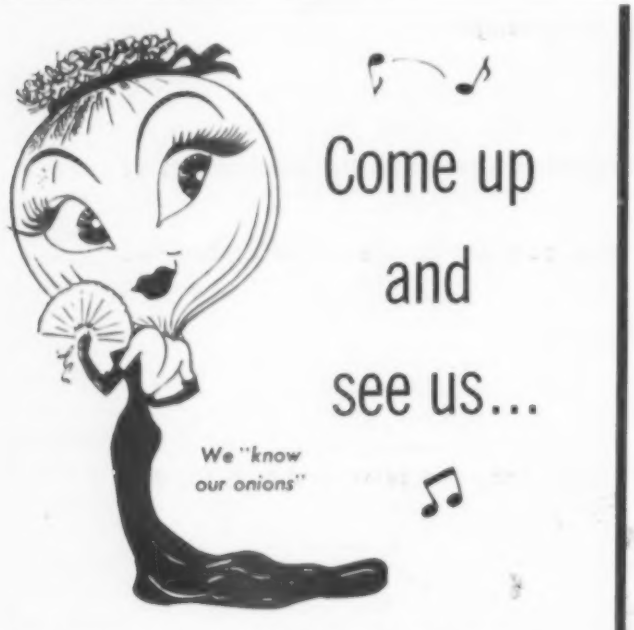

Abstracts

(Continued from page 34)

ever, none of the salts added improve the soly. to any great extent. The combination of sodium citrate (0.2%) and ascorbic acid (0.01%) was most influential of the salts in preventing the development of "off" flavors. The addn. of emulsifying agents at the rate of 0.05% on a reconstituted basis caused churning of the butterfat when the powder was reconstituted. However, the use of emulsifier very materially improved the keeping quality of the milk powder during storage at both 45° and 85° F.

The protein and non-protein nitrogen fractions in Milk. III. The effect of heat treatments and homogenization.

SHAHANI, K. M., AND SOMMER, H. H. *J. Dairy Sci., 34*, 1035 (1951).

Influence of pasteurization on the nitrogen distribution was studied by pasteurizing milk at 143° F. for 30 min. in a lab. pasteurizer. No appreciable change occurred on pasteurization, except in the case of albumin and globulin. About 9% coagulation was observed in the case of albumin and 5% coagulation for globulin. Pasteurization at 155° F. for 30 min. and homogenization at 2,000 lbs. p.s.i.g. produced no significant changes in the nitrogen distn., except that globulin nitrogen decreased, whereas the non-protein nitrogen and α-amino nitrogen increased. On storage of evapd. milk at 100° F., the non-protein nitrogen increased with a decrease in viscosity.

PECTIN

Studies of acetylated pectic acid.

SOLMS, J., AND DEUEL, H. *Helv. Chim. Acta., 34*, 2202 (1951).

Pectic acid was acetylated with acetic anhydride in a mixt. of formamide and pyridine. The properties of various acetylated pectic acids have been investigated and discussed. With increasing degree of esterification, the following changes were observed: decrease of coagulability with neutral salts from aq. soln., increase of the viscosity of aq. soln., less degradation of the pectin chain mols. by the enzyme pectinase. Many of these properties change similarly as in the esterification of the carboxyl groups with methanol. Pectic acid loses its ability to gel by introducing a few acetyl groups; highly acetylated pectic acid, however, is able to form firm gels.

STARCHES

Some recent developments in the academic fields of starch chemistry.

BOURNE, E. J. *Chem. Ind.*, 1047 (1951).

Developments over the last 10 years in such fields as the fractionation of starch, the characterization of amylose and amylopectin, the synthesis of amylose and the synthesis of amylopectin. 162 references.

TASTE TESTING

Diurnal variations in acuity of sense of taste for sodium chloride.

IRVIN, D. L., AND GOETZI, F. R. *Proc. Soc. Exptl. Biol. Med., 79*, 115 (1952).

Expts. are described demonstrating the existence in normal individuals of diurnal variations in acuity of the sense of taste for sodium chloride. Freely selected meals were found to be preceded by a period of increasing and followed by one of de-

creasing acuity of that sense. When meals had been omitted the decrease in acuity failed to occur.

VEGETABLES

Specific gravity - dry matter relationship in potatoes.

VANASSE, N. A., JONES, I. D., AND LUCAS, H. L. *Am. Potato J., 28,* 781 (1951).

The sp. gravity-dry matter relationship of potatoes grown in North Carolina was detd. Location of production and variety of potato had a statistically significant effect on the sp. gravity-dry matter relationship. Size of tuber was not significant but appeared to be somewhat greater than the effect of variety. These factors, though in some cases statistically significant, did not greatly affect predicted dry matter values. A prediction equation and a prediction error were given for the estn. of dry matter content of potatoes from sp. gravity measurements irrespective of size tuber, variety, or location grown in North Carolina.

INDUSTRIAL CHEMISTRY

Is there a "chemicals in food" problem?

KLEINFELD, V. A. *Food Drug Cosm. Law J., 6,* 824 (1951).

An attempt is made to indicate that many qualified persons in a position to offer authoritative opinions are of the belief that a most serious problem exists with respect to the increasing employment in and on food substances where long range effects on the human system are unknown.

Practicality in regulation of "chemicals in food" problem.

MULFORD, K. E. *Food Drug Cosm. Law J., 6,* 850 (1951).

The practical problems involved in the chemicals in food question with emphasis on proof of safety, levels and methods of usage factor, and technological usefulness.

Control of odors.

WEAVER, E. R. *Natl. Bur. Standards Cir.,* 491 (1950); *Refrig. Abstracts, 6,* 176 (1951).

The surest method of disposal of industrial odors in foul air is to pass the air through a flame. Usually the most practicable method of concg. the odor is by adsorption with activated carbon. The adsorbed odor must then be driven off by heating the carbon. Foul industrial plant air should be dild. and discharged from as tall a stack and at as high a temp. as practicable. To adsorb odors in a refrigerator with carbon, the odors must be in the air. Enclosing each food in a tight container is a practical means for preventing transfer of odors. The presence of ozone is dangerous. Masking of odors by the discharge of other odors may be objectionable to some persons. Chlorophyll has nothing to do with deodorization. 38 references.

PACKAGING

New Swedish package.

Food Packer, 32, 34, December, 1951.

Revolutionary package for milk and other liquids shaped like a tetrahedron and called "Tetra Pak."

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Abstracts

Factors in waxed-paper sealing.

MUELLER, G. P. *Modern Packaging, 25,* 125, December, 1951.

An examn. of the factors affecting the heat-seal strength of paraffin waxed papers. Within defined limits, sealing pressure, rate, and amt. of surface wax were found to have little effect on seal strength. Aside from inherent properties of the wax and the base sheet, the conditions predominant in affecting seal strength are those which influence the cooling rate of the seal. The more rapid the cooling rate, the stronger the seal. Factors governing this rate include coolant temp., temp. of the wax, total mass to be heated and cooled, and time required for heating and cooling.

PHYSICAL RESEARCH

The study of the structure of proteins by physical methods.

Brit. Gel. Glue Res. Assoc. Abstracts, 2, 1, November, 1951.

A summary of recent progress in the study of the structure of collagen and gelatin by means of X-ray diffraction, polarized infrared radiation, and optical rotation.

Electrophoresis.

GRAY, G. W. *Sci. American, 185,* 45, December, 1951.

A description of the development of electrophoresis from the earliest type instruments down to the latest developments. The new "zone electrophoresis" method is described.

PATENTS (U. S. A.)

Process of roasting coffee.

SCULL, W. S., AND FISHER, G. A. Assignors to Wm. S. Scull Co. 2,581,148, January 1, 1952.

In the roasting of coffee wherein the coffee is dehydrated, developed and colored, the process which comprises subjecting the coffee to heating in 3 stages of treatment in successive zones having factors of time and temp. providing a time temp. relationship in each zone differing from that in the other zones, the time temp. relationship in the first zone providing for max. roasting effect herein, the time temp. relationship in the third zone providing min. roasting effect therein, the time temp. relationship in the intermediate zone providing an intermediate roasting effect therein, the temp. in the first zone being between 600° F. and 1200° F. and at least one of factors being progressively diminished from zone to zone.

Process of comminuting food products.

HENDRY, J. L., AND PEDERSON, R. R. 2,583,697, January 29, 1952.

A process of comminuting and preserving an edible flavoring material selected from the group consisting of coconut meat, cocoa beans and vanilla beans and parts thereof, ginger root and spices, which comprises contacting such material with liquefied nitrogen until the temp. of such material is reduced to not substantially above —100° F., and then, while in such refrigerated condition and in contact with concd. nitrogen, subjecting same to the action of a hammer-mill until the bulk thereof is reduced to a particle size of substantially below 30μ, and then packaging such material while still impregnated with nitrogen of a high concn.

PATENTS (GREAT BRITAIN)

Method of producing jellying pectins.

BERGLUND, D. T. British Patent 651,907 (May 20, 1948), Swed. (June 27, 1947); *Brit. Abstracts, BIII,* 525 (1951).

Pectin capable of producing jellies with sugar and acid is prepd. from beet pectin by subjecting it to controlled hydrolysis so that the acetyl groups are reduced to $\geq$10 per 100 galacturonic acid groups and the Me groups maintained at >30.

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Advertisers' Index

	PAGE
American Can Co.	1
Anheuser-Busch, Inc.	7
Basic Vegetable Products, Inc.	36
Brewers Yeast Council, Inc.	36
Continental Can Co.	22-23
Distillation Products Industries	15
The Diversey Corp.	16
Dodge & Olcott, Inc.	28
Felton Chemical Co., Inc.	31
Firmenich, Inc.	4th cover
Florasynth Laboratories, Inc.	17
Food Development Laboratory	40
Food Machinery & Chemical Corp.	21
Food Research Laboratories, Inc.	40
Fritzsche Bros., Inc.	40
General Foods Corp. (Diamond Crystal Salt)	30
Givaudan Flavors, Inc.	27
The Griffith Laboratories, Inc.	3rd cover
Hoffman-LaRoche, Inc.	20
The Huron Milling Co.	32
Johns-Manville Corp.	33
H. Kohnstamm & Co., Inc.	19
LaWall & Harrisson	36
Magnus, Mabee & Reynard, Inc.	2
Merck & Co., Inc.	10
Minneapolis-Honeywell Regulator Co.	4-5
Norda Essential Oil & Chemical Co.	37
The Pfaudler Co.	2nd cover
Chas. Pfizer & Co., Inc.	11
Schwarz Laboratories, Inc.	37
Seaplant Chemical Corp.	34
Foster D. Snell, Inc.	40
Sterwin Chemicals, Inc.	13
Sugar Information, Inc.	29
Tennessee Eastman Co.	9
U. S. Stoneware Co.	25
van Ameringen-Haebler, Inc.	35
Vegetable Juices, Inc.	39
Wahl-Henius Institute	38
Wallace & Tiernan Co., Inc.	38

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Older methods consisted of stamping 4-inch discs in 9 places on a sample sheet, and the test sheets became scrap. With the new methods, tests are made without destroying or injuring the sheet. [From *Aminco Lab. News*, 8 (5) 2 (1951) September.]

NEW AUTOMATIC SARDINE COOKER DEVELOPED

An automatic cooker for sardines, brisling, and other fish has recently been developed by the International Machinery Corporation, S. A. in Belgium, a March 1951 article in the Danish periodical *Konserves* reports.

By this new method, cans are automatically filled with raw fish and cooked in steam or hot air. All fats and fish oil are extracted from the fish during the process. Next, oil or tomato sauce is added to the cans and the machine completes the process by sealing the cans at a temperature of 185° to 194° F. (85° to 90° C.).

The new method reduces the handling of the fish by 20 to 60%. Oil savings are claimed to be 15% higher than by former methods. [From *Com. Fisheries Rev.*, 13 (8) 28 (1951) August.]

COMMUNITY HEALTH PLANNING KITS

Aids for organizing new health councils or for improving existing ones are to be found in a new kit development by the National Health Council. The pamphlets, leaflets and reprints composing the kit are divided into six sections, covering various topics such as structure and financing, programs, activities, major problems of health planning bodies, services and responsibilities of local health departments. The sections are arranged so that they may be used separately. These kits are loaned for a month at a time, with the privilege of renewal, or may be bought for $2.50. Requests should be addressed to the National Health Council, 1790 Broadway, New York 19, New York.

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WANTED: Graduate Food Technologists or college graduates with chemistry major for quality control with large packer of Fruit and Vegetables. Also want Analyst for Chemistry Lab. Prefer girl. Locations Midwest. REPLY BOX 198, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

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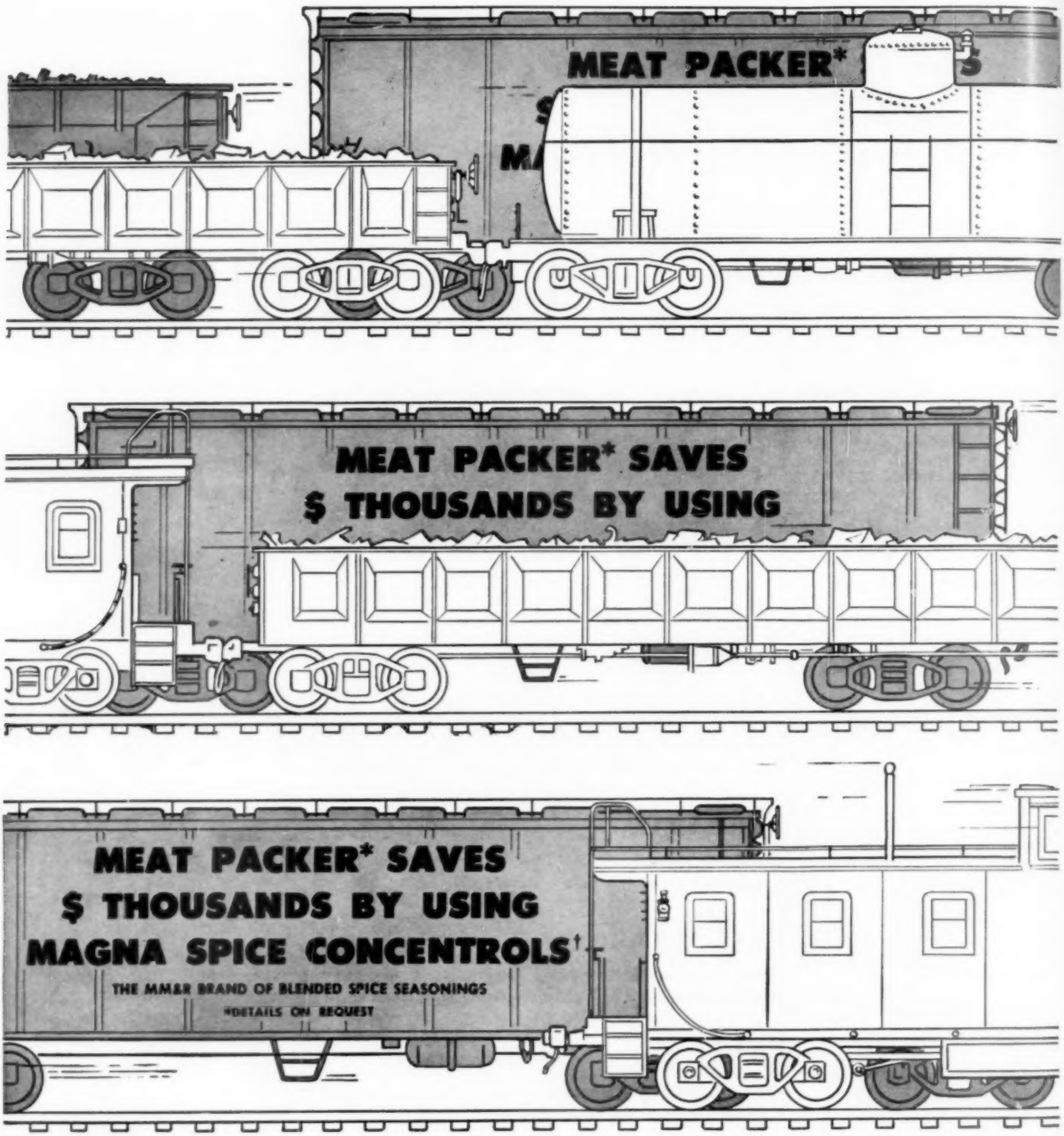

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CONTENTS

BIOCHEMICAL PREVENTION OF FLAVOR AND CHEMICAL CHANGES IN FOODS AND TISSUES STERILIZED BY IONIZING RADIATIONS. Bernard E. Proctor, Samuel A. Goldblith, Charles J. Bates, and Olivia A. Hammerle 237

NATURAL FLAVOR RETAINED IN NEW FROZEN UNCOOKED APPLE PULP. Gestur Johnson and Duane K. Johnson . . 242

COMPARATIVE HEATING RATES OF BENTONITE SUSPENSIONS IN JARS PROCESSED IN BOILING WATER AND IN STEAM AT ATMOSPHERIC PRESSURE. John J. Powers, Dan E. Pratt, and Willaminta Norris 246

NEW DESIGNS AND TECHNIQUES FOR ORGANOLEPTIC TESTING. Milton E. Terry, Ralph Allan Bradley, and Lyle L. Davis 250

PRESERVATIVE EFFECT OF VARIOUS CONCENTRATIONS OF CURING SALTS IN COMMINUTED PORK. Cornelius Bulman and John C. Ayres 255

A COMPARATIVE STUDY OF TENDERNESS DETERMINATION BY SENSORY PANEL AND BY SHEAR STRENGTH MEASUREMENTS. F. E. Deatherage and George Garnatz 260

SURFACE FORMATION AND SHEAR AS FACTORS AFFECTING THE BEATING POWER OF EGG WHITE. Dwight H. Bergquist and George F. Stewart 262

STABILITY OF THE ANTHOCYANIN PIGMENTS IN CONCORD GRAPE JUICE. L. V. L. Sastry and R. G. Tischer 264

A STUDY OF METHODS FOR THE MEASUREMENT OF TOMATO JUICE COLOR. W. B. Robinson, T. Wishnetsky, J. R. Ransford, W. L. Clark, and D. B. Hand 269

DETECTION OF COMMERCIAL DODECYLBENZENE SODIUM SULFONATE IN CANNED FOODS. Jay C. Harris and Frank R. Short 275

RADIOLOGICAL CONTAMINATION OF FOOD. I. G. Poppoff, Lt. G. W. Morrison (MSC) USN, and F. R. Holden . . . 278

BOOK REVIEW 280

REGIONAL SECTION NEWS *6*

SELECTED ABSTRACTS *12*

Authors of papers intended for publication in FOOD TECHNOLOGY should request from the editorial office a copy of the booklet, entitled "Information and suggestions to authors." Manuscripts submitted for publication in FOOD TECHNOLOGY should follow the style described in this booklet.

The Institute of Food Technologists assumes no responsibility for statements in contributed articles appearing in FOOD TECHNOLOGY. Editorials present only opinions of the writers and do not necessarily reflect policies of the Institute of Food Technologists.

Bernard E. Proctor

President, Institute of Food Technologists, 1952-1953

Bernard E. Proctor was born in Malden, Mass., in 1901 and was graduated as salutatorian from the Malden High School in 1919. He received the B.S. degree in Biology and Public Health in 1923 and the Ph.D. degree in 1927 at the Massachusetts Institute of Technology. In 1924 he married Miriam Patten of Andover, Mass.

BERNARD E. PROCTOR

From 1923-1926 he was an instructor in biochemistry at the Boston University School of Medicine and from 1925-1926 an assistant at the Massachusetts Institute of Technology. He became an instructor at M. I. T. in 1926 and an Assistant Professor in 1930. He was named Associate Professor of Food Technology and Industrial Biology at M. I. T. in 1937, Professor of Food Technology in 1944, Director of the Samuel Cate Prescott Laboratories of Food Technology in 1945, and Acting Head of the Department of Food Technology in January 1951. In March 1952, he was appointed Head of the Department, which will soon be housed in a new, modern building, the John Thompson Dorrance Laboratories building.

Professor Proctor has done valuable research in food preservation, fermentation, microbiology, electronic sterilization of foods, and sanitation. He has written a textbook on "Food Technology" with Prof. Emeritus Samuel Cate Prescott (published in 1937) and is the author of numerous papers published in leading scientific periodicals. He was Associate Editor of Food Technology from 1947-1949 and Associate Editor Refrigerating Data Book, Section III of Refrigeration Applications Volume, American Society of Refrigerating Engineers, 1950 edition.

Professor Proctor has a distinguished record of public and professional service. During World War II he served as expert consultant on foods to the Secretary of War and as Director of Subsistence and Packaging Research and Development, Office of the Quartermaster General. He is currently a special consultant to the United States Public Health Service.

Since the war he has participated actively in several National Research Council Committees relating to foods, military problems, engineering, and health.

He is at present a liaison representative of the Food Protection Committee of the National Research Council's Food and Nutrition Board, a member of the Board of Directors of the Associates, Food and Container Institute of the Armed Services, a member of the Refrigeration Research Foundation Advisory Council, and chairman of the Herman Frasch Foundation Award Committee of the American Chemical Society.

He is a member of the American Chemical Society and in 1950-1951 acted as chairman of the Division of Agricultural and Food Chemistry. He is also a member and fellow of the American Public Health Association, a fellow of the American Association for the Advancement of Science, and a member of Sigma Xi, American Society of Refrigerating Engineers, and the Society of American Bacteriologists.

As a founder member of the Institute of Food Technologists, Dr. Proctor has participated actively in the affairs of the Institute since the M. I. T. Food Technology Conferences in 1937 and 1939, which stimulated the formation of the Institute of Food Technologists. In 1947 he served as chairman of the Northeast Section and as chairman of the Coordinating Committee for the 7th Annual Conference of the Institute in Boston, Mass. In 1951-1952 he acted as chairman of the Committee on Chemicals in Foods and the Committee to Study Awards and to Recommend Procedures of Acceptance of Gifts, Donations, and Endowments. He became President-Elect in June 1951 and President of the Institute in June 1952.

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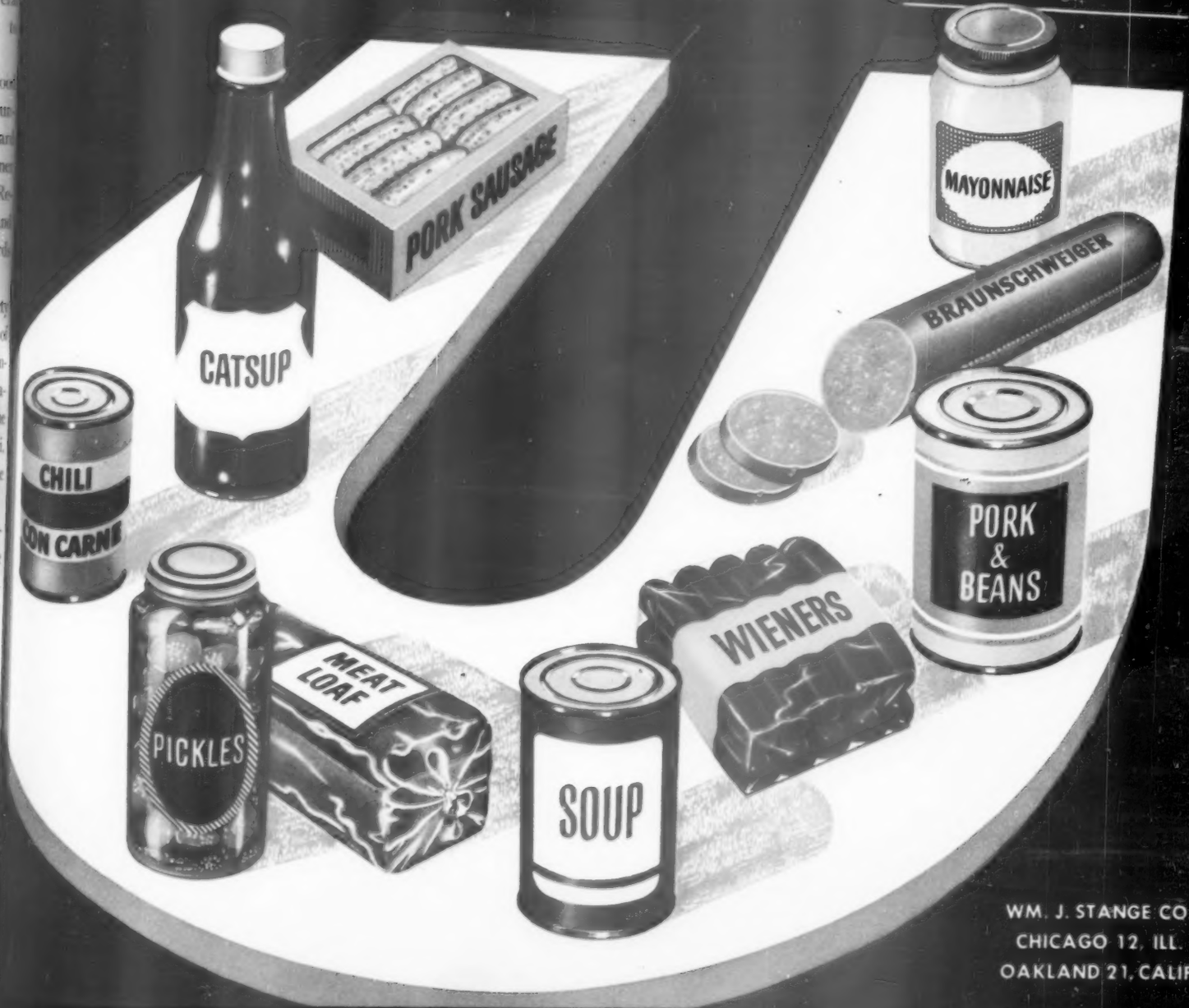

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Dedication of the New Food Technology Building of the University of California at Davis

Dedication of the new University of California food technology building took place on University Charter Day, March 19, 1952. Final arrangements for the transfer of the entire Food Technology division from the Berkeley campus to the Davis campus will have been completed by June 1952.

Knowles A. Ryerson, Assistant Dean of the College of Agriculture, presided during the dedication ceremonies. Senator Earl D. Desmond from the 19th District, Sacramento, spoke on "The interest of legislature and the public in the food technology developments at Davis." Norman Olson, of the National Canners Association (Berkeley) discussed "The canners' interest in food research"; Robin Russel of Mutual Orange Distributors (Redland) "The freezers' interest in food research" and Paul L. Johnson of the Raison Advisory Board (Fresno), "The dehydrators' interest in food research."

The future role of the new building in the education of students in food technology was evaluated by L. W. Richards of the Bercut-Richards Co., of Sacramento. The Dedicatory Remarks were made by Acting Dean Stanley B. Freeborn.

The relocation of the division on the Davis campus of the vast University of California system will permit increased study of processing methods for new varieties of fruit and vegetables now being developed by other divisions of the college and for meat and poultry. In their new headquarters, new canned products may be developed and consumer-tested to find new outlets for surplus fruits. The unique building will be equipped to carry on canning operations with both commercial and pilot scale equipment.

Under the direction of Dr. Emil Mrak, division chairman, both undergraduate and graduate work will receive special emphasis in the new Food Technology headquarters. In addition to its outstanding faculty and research staff the building will feature the latest in equipment.

Eleven new freezing storage rooms and an air blast freezer will make this station one of the best for frozen foods in the United States. Fundamental research in the roles of enzymes, food microbiology, pectins, vitamin behaviors, color and flavor changes, and histological changes will be continued. The consumer preference testing laboratory, the first of its type in California, will have facilities for testing the new processed foods coming out of the research laboratories. Basic studies in flavor and odor constituents, relation of processing to flavor and effects of chemicals on flavor are planned as a part of this work.

Equally as important as research is the need for trained personnel. There is a growing demand for graduates in food technology as well as for training through conferences and short courses. The enlarged facilities available to the Division of Food Technology in the new building will permit the Division to enlarge and accelerate its primary job of teaching the science of food preservation.

Regional Section News

AMES SECTION

The Ames Section met in the Pine Room of the Memorial Union on Friday, April 18, 1952. The afternoon session started with a panel discussion on "Advertising in Today's Self Service Economy" by a group of leaders in the advertising field in Iowa. The panel members included:

E. W. Munsell, W. D. Lyon Co., Cedar Rapids, Iowa.
R. B. Creswell, W. D. Lyon Co., Cedar Rapids, Iowa.
R. Quackenbush, Grocery Wholesale, Des Moines, Iowa.
L. I. Peterson, Canned Goods Advertising, Des Moines, Iowa.
R. S. Prewitt, of McElroy and Prewitt, Cedar Rapids, Iowa.

After the panel discussion, the following papers were heard:

"Modern Trend in the Canning Industry" by C. L. Smith, Continental Can Co., Central Division, Chicago, Illinois.
"Antioxidants Now Stabilize Eleven Food Types" by H. E. Whitmore, Universal Oil Products Co., Chicago, Illinois.

Dr. R. M. Hixon, Dean of the Graduate College, Iowa State College, Ames, was the dinner speaker. He gave an excellent talk on "Fractionation of Starch into Amylose and Amylopectin, the Structure and Properties of These Two Molecular Types, and the Application of this Information to the Properties of Granular Starch."

The Ames Section elected the following officers for 1952-53:

Chairman: L. B. Drake, American Can Co., Waterloo, Iowa.
Vice-Chairman: G. E. Cooper, Rath Packing Co., Waterloo, Iowa.
Secretary-Treasurer: Frances Carlin, Iowa State College, Ames, Iowa.
Councilor: John C. Ayres, Iowa State College, Ames, Iowa.

The following were appointed chairmen for the committees: Membership: R. G. Tischer, Iowa State College; By-Laws: Belle Lowe, Iowa State College; Program: John Meader, Continental Can Co., Des Moines, Iowa. Considerable credit for the excellent meetings this past year should be given to Glen Cooper, Program Chairman and Ruth Chambers, Publicity Chairman, both from the Rath Packing Co., Waterloo, Iowa.

CHICAGO SECTION

Professor L. J. Norton of the Department of Agricultural Economics in the College of Agriculture at the University of Illinois addressed the Chicago Section at the Palmer House on Monday, May 19 on the "Impact of Price Ceilings on Agricultural Production." Price ceilings, he said, have not in general been a deterrent to production in the U. S. A. since they were imposed in 1951. The potato shortage may be due to the effect of ceilings, but in most all other cases production has been

(Continued on page 10)

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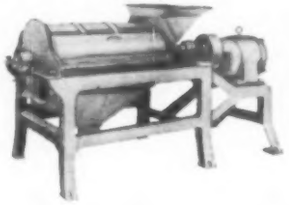

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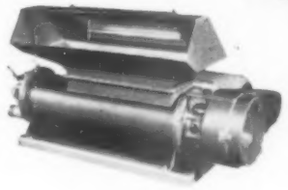

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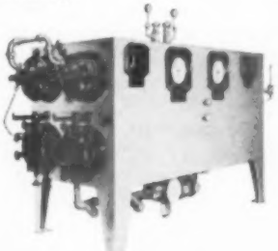

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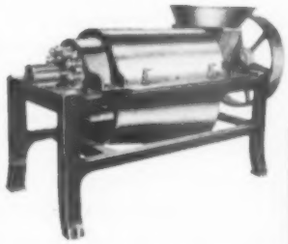

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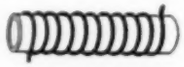

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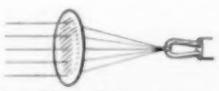

measure by means of radiated heat, applicable to moving objects . . . to direct measurement of work temperature . . . to extremely high ranges and for many jobs impossible with any other element.

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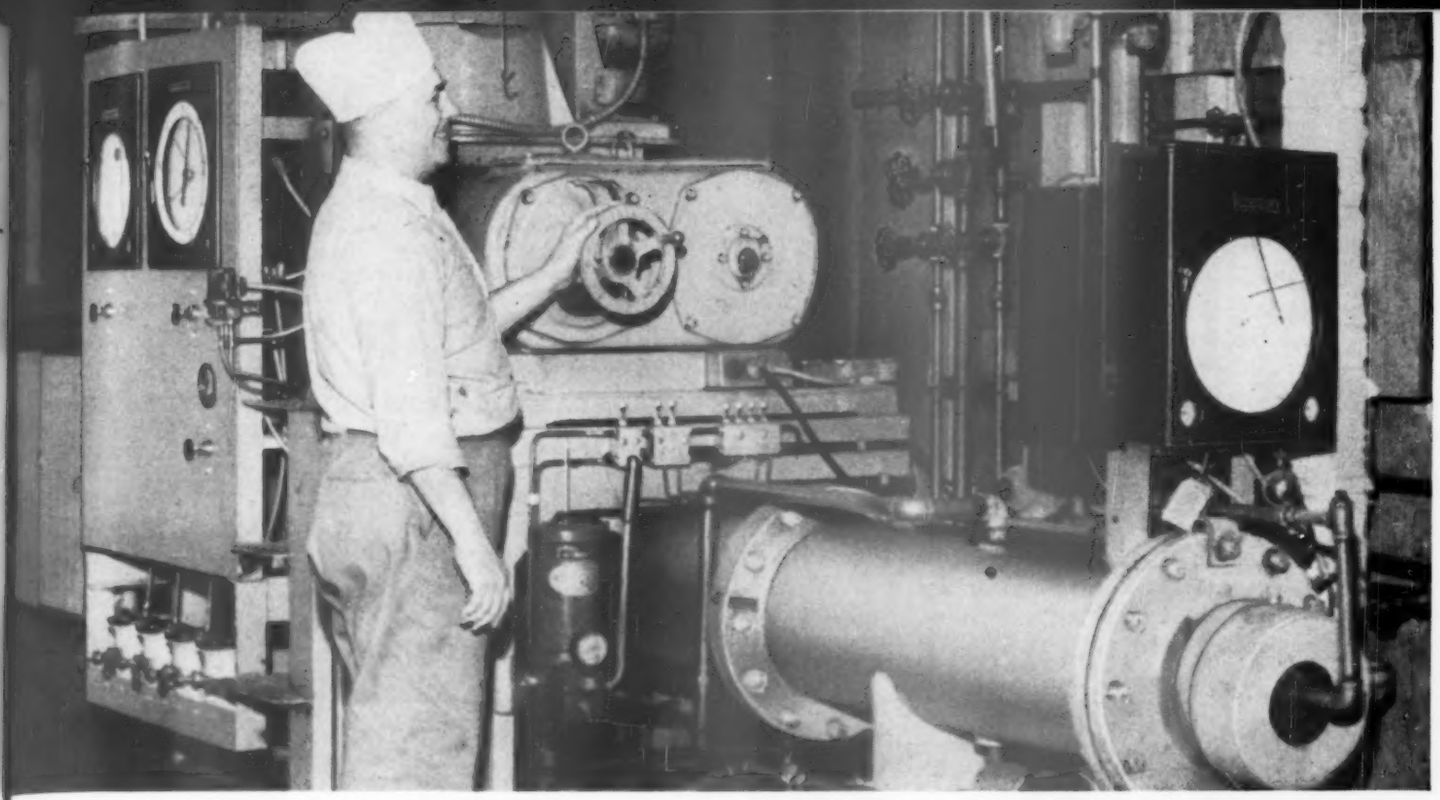

QUALITY OF CHOCOLATE *bars produced by this continuous molding and tempering machine is maintained by an accurate temperature control system, which combines an* ***ElectroniK*** *controller with controlling thermometers to hold critical temperatures within split-degree limits.*

in the food industry demand *temperature control*

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Regional Section News

(Continued from page 6)

modified by other factors. At present, most prices of commodities, such as cotton, corn, soybeans, etc. are well below ceiling prices. It is obvious that ceilings had very little to do with this decline in prices.

PHILADELPHIA SECTION

The Section held its May meeting on the 15th in the Whittier Hotel in Philadelphia, Pa. Dr. L. V. Burton addressed the group on the subject: "Sense and Nonsense about Packaging." Dr. Burton, who is Executive Director of The Packaging Institute, New York, N. Y., has addressed other IFT Sections on this topic which has been popularly received.

PUGET SOUND SECTION

The Section held its second Annual Donors' Banquet on April 24th at the Chamber of Commerce Hall in Seattle, Wash. In attendance were leaders of northwest industries representing management and technology, food control agencies, civic groups, the State College and the University of Washington. The governor of Washington, the Honorable Arthur B. Langlie, was the main speaker of the evening. He discussed the importance of the food industry to the development of the State, and the importance of the food technologist in its progress.

Appetizers for the social mixer hour and the dinner that followed were provided through the courtesy of the northwest food industries. Books and journals pertaining to the science of food technology, canned and packaged food items, and frozen food in freezer cases were displayed, providing appropriate atmosphere. Door prizes and unusual gift items were offered along with splendid musical entertainment. Everyone had a thoroughly enjoyable time, which was mainly attributable to the fine cooperation and assistance received from the participating industries.

OREGON SECTION

On May 17th, the Oregon Section held its annual meeting at the Heathman Hotel, Portland, Oregon.

A business meeting and election of officers preceded the dinner which was followed with an interesting program. Mr. K. K. King, Owens-Illinois Glass Company, gave a short talk on glass and showed the film "Glasstown." Miss Alice Gerber, Oregon Dairy Council, gave an informative talk on the activities of the Dairy Council and proper dieting. Her talk was followed with the film "Weight Reduction Through Diet." The film was based on a research project at Michigan State College.

Following are the 1952-53 fiscal year officers:

Chairman: C. L. Beardsley, Apple Growers Assn., Hood River, Oregon

Vice Chairman: A. H. Nagel, Birds Eye Division, General Foods Corp., Hillsboro, Oregon

Secretary-Treasurer: H. Y. Yang, Food Technology Dept., Oregon State College, Corvallis, Oregon

Councilor: G. A. Richardson, Dairy Dept., Oregon State College, Corvallis, Oregon

Executive Committee: E. H. Wiegand, Food Technology Dept., Oregon State College, Corvallis, Oregon; L. A. Pettit, Food Technology Dept., Oregon State College, Corvallis, Oregon; A. C. McCully, Eugene Fruit Growers Assn., Eugene, Oregon; O. J. Worthington, Food Technology Dept., Oregon State College, Corvallis, Oregon

SAMUEL CATE PRESCOTT STUDENT CHAPTER

The annual election of officers of the Samuel Cate Prescott Student Chapter of IFT at the Massachusetts Institute of Technology was held on May 15, 1952. The following were elected to serve for the coming year:

President: Donald B. Miller

Vice-President: Hubert C. Harriman

Secretary-Treasurer: George A. Wallace, Jr.

The annual student-faculty meeting of the Chapter was held on May 8, 1952. Thirty students and faculty met to enjoy a delicious repast. Following the dinner, an entertaining talk entitled: "Futures in Foods" was presented by Professor Bernard E. Proctor, Head of the Department of Food Technology at M. I. T., and President-Elect of the IFT.

PERSONNEL

STEPHEN LAUFER, Director of Brewing Technology of the Schwarz Laboratories, New York, N. Y., has been elected President of the American Society of Brewing Chemists. Dr. Laufer, who is well known for his many contributions to the chemistry and technology of brewing and fermentation, has been actively engaged in the affairs of the A.S.B.C. since its inception in 1934.

JOHN T. R. NICKERSON has been appointed to the rank of Assistant Professor in the Department of Food Technology at the Massachusetts Institute of Technology, Cambridge, Mass.

GORDON PETERSON of the Continental Can Company of Chicago, Ill., has been elected President of the Chicago Chemists' Club.

OBITUARY

GEORGE L. BAKER, Research Professor of Chemistry, University of Delaware Agricultural Experiment Station, Newark, died on May 29. He was a graduate of the University of Massachusetts and of the University of Delaware, and joined the Delaware Experiment Station in 1923. In 1943 he was appointed Assistant Director of the Experiment Station.

Professor Baker was an enthusiastic member of the IFT, active on various committees of the Institute and of other professional organizations. He made many important contributions to the chemistry and technology of fruits and vegetables but was best known for his extensive and epoch-making investigations of pectic substances and their role and behavior in food products. His work paved the way for many important developments in that field and gained him and his University world-wide reputation.

SENSATIONAL NEW COFFEE IMITATION ANNOUNCED

Authentic Felton Reproduction, Felcafé, Revolutionizes Use of Coffee Flavor In Vast New Fields

As a result of several years of research and development, Felton Chemical Company chemists have produced a new coffee flavor that has revolutionized the use of coffee in many products. Candy, ice cream and baked goods manufacturers have long been aware of the handicaps presented by the lack of stability of coffee flavor concentrates, and it was this problem which Felton tackled first. Literally hundreds of new chemicals were isolated in the search for proper ingredients, and at least fourteen new specific aromatics were developed.

Never before has a flavor succeeded in accomplishing all phases of such important matter as no distortion found in any of the products Study carefully the ingredients were listed as outlined in the Felton contributed to the most important Never before has a flavor succeeded in accomplishing all phases of such important matter are no distortion found in any of the products Study carefully the ingredients were listed as outlined in the Felton contributed to the most important Never before has a flavor succeeded in accomplishing all phases of such important matter are no distortion found in any of the products Study carefully the ingredients were listed as outlined in the Felton contributed to the most important Never before has a flavor succeeded in accomplishing all phases of such important matter are no distortion found in any of the products Study carefully the ingredients were listed as outlined in the Felton contributed to the most important Never before has a flavor succeeded in accomplishing all phases of such important matter are

75 Times Stronger Than Coffee

Felcafé has been found to be at least 75 times stronger than coffee, and its economy is quickly obvious to any manufacturer. Thousands of batch tests have been made, not only by Felton, but by manufacturers using flavors, and based on the commercial conditions of manufacture in the candy, ice cream, dessert, beverage and extract fields. Felcafé has proven its record-breaking economy.

Will Not Cook or Freeze Out

Felton's unusual flavor is non-volatile, and its stability eliminates any worry about cooking off or freezing out. Neither does it oxidize or become rancid.

Candy Manufacturers Applaud Advantages

Felcafé retains its full-bodied flavor in Hard Candy, Toffee, Caramels, Fudge, Soft Centers, Creams and Fondants, Marshmallows, Gum, Starch Jellies, Chocolate.

Ideal for Foods and Desserts

Popular coffee flavor can now be successfully applied to Ice Cream, Ices and Sherbets, Packaged Ice Cream Mixes, Puddings, Syrups, Beverage Concentrates, Gelatin, Pie Fillihgs, Cake Fillings, Icings, Toppings, Sandwich Fillings, Carbonated Beverages, Extracts.

Versatility of New Flavor for Pharmaceuticals

Coffee as a flavor for pharmaceuticals can be a big factor in the success of all kinds of products such as Pharmaceuticals, Lozenges, Troches, Vitamin Tablets, Cough Syrup, Elixirs.

Write For Samples of This Amazing Coffee Flavor

Tell us about the products in which you would like to use Felcafé. We will be happy to send you directions and liberal samples for testing.

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Selected Abstracts[a]

ANALYTICAL METHODS

Controlled potential electrolytic separation and determination of copper, bismuth, lead, and tin.

LINGANE, J. J., AND JONES, S. L. *Anal. Chem., 23,* 1798 (1951).

The optimum conditions for the successive sepn. and detn. of copper, bismuth, lead, and tin from a tartrate soln. by automatic controlled potential deposition onto a platinum cathode have been established. The influences of such important variables as pH, total tartrate concn., temp., and cathode potential have been investigated. All 4 metals may be detd. without any intermediate treatment of the soln., except acidification for the detn. of tin, in a total elapsed time of about 4 hours (1 hour of actual operator time). Very few other elements interfere. The beneficial effect of hydrazine and hydroxylamine as addn. agents has been investigated, and their oxidation products at a platinum anode have been identified. Hydrazine in the presence of chloride ion is a much more efficient anodic depolarizer than hydroxylamine, and it plays a more important role by reducing + 2 copper to a chloro cuprous complex which greatly accelerates the copper deposition.

Analytical studies concerned with the reactions between organic peroxides and thioethers. III. Analysis of mixtures of peroxides and sulphoxides.

BARNARD, D., AND HARGRAVE, K. R. *Anal. Chim. Acta., 6,* 23 (1952).

By a suitable combination of methods previously described for the independent detns. of hydroperoxides and sulphoxides it is found that a mixt. of these two substances can be satisfactorily analyzed for each constituent. It is necessary to divide a given sample into two aliquots, one being analyzed for hydroperoxide, the other for the sum total of hydroperoxide and sulphoxide. Modifications necessary when allylic sulphoxides are present are discussed.

Determination of sodium carboxymethylcellulose in detergent mixtures.

BLACK, H. C. *Anal. Chem., 23,* 1792 (1951).

The green color formed by reaction of anthrone with carbohydrate materials in sulfuric acid soln. provided the basis for the present method. Color intensity is measured with a spectrophotometer. Controlled heating is necessary for reproducible results. Color intensity varies inversely with degree of substitution of the carboxymethylcellulose. The accuracy is 2% relative, provided the degree of substitution is known. Other carbohydrates, carbohydrate derivs., furfural, 5-hydroxymethylfurfural, and certain polyoxyethylene derivs. of fatty acids and phenols are the only known interfering substances. The method should be useful for detn. of carboxymethylcellulose in other mixts. and, with appropriate modification, of other carbohydrates and carbohydrate derivs.

Determination of small concentrations of carbonyl compounds by a differential pH method.

ROE, H. R., AND MITCHELL, J. *Anal. Chem., 23,* 1758 (1951).

The method developed involves measurement of the pH of 0.5 *N.* aq. hydroxylamine hydrochloride before and after addn. of the sample. The decrease in pH is a direct function of the amt. of carbonyl compd. in the sample. Calibration by a standard working curve permits accurate quant. analyses. This 5-minute procedure has been applied successfully to 0.0 to 0.023 millimole per ml. of aldehydes and methyl ketones in benzene, dioxane, methanol, or water soln.

Analysis of aldehydes, ketones, and combined carbonyls in presence of each other.

BUCHANAN, R. H. *Australian J. Appl. Sci., 2,* 276 (1951); *Brit. Abstracts, C, 12* (1952).

Three interlocked quant. volumetric analyses, based on the oxime reaction are described; these differentiate volatile aliphatic aldehydes, ketones, and combined carbonyls such as acetals, formals, and cyclic aldehyde polymers. Ketals and vinyl ethers may be expected to behave like combined carbonyls. The tests are useful in the Fischer-Tropsch, alcohol-dehydrogenation, hydrocarbon-oxidation, and other processes involving aldehydes. In the "ketone" test, aldehydes are oxidized by alk. Ag_2O to the non-volatile Na salt of the coresponding acid. The ketone and combined carbonyl are distd. into NH_2OH,HCl maintained at pH 5-6; only the ketone reacts. In the "free carbonyl" test, aldehydes and ketones form the oxime at pH 5 6; aldehydes are calcd. by difference. At pH 1.5-3 the total carbonyl content is detd. as oxime, combined carbonyls being hydrolyzed at this pH and at elevated temp. to liberate reactive carbonyls. Combined carbonyls are calcd. by difference. The end-point error of the titration, using methylorange, is approximately 1%; the total error when analyzing by difference is often greater than 2%.

Detection of ethylene glycol in forensic chemical analysis.

LAPKINA, N. B., AND NAZARENKO, V. A. *J. Anal. Chem. USSR, 6,* 262 (1951); *Brit. Abstracts, C, 19* (1952).

Entrainment distn. of dil. solns. of ethylene glycol with benzene yields all the ethylene glycol with the water even at a concn. of 0.001%. Detection of the glycol is most conveniently carried out by the periodate reaction, but this reaction is given also by decompn. products of certain sugars and organs rich in glycogen (liver). Interference is prevented by addn. of oxalic acid before distn.

Detection of DDT in flour.

ALESSANDRINI, M. E., AND AMORMINO, V. *Roy. Can. Inst. sup. Sanit., 14,* 619 (1951); *Brit. Abstracts, C, 66* (1952).

The sample of flour (20 g.) is extd. with ether (3 × 50 ml.); the ether is evapd. and the residue dissolved in $CHCl_3$. The soln. is extd. with 10% Na_2SO_4-H_2SO_4 (2 × 5 ml.), 10% oleum (5 ml.) and 10% Na_2SO_4-H_2SO_4 (2 × 5 ml.) to sep. from fats; the acid exts. are washed with $CHCl_3$ (20 ml.). The combined $CHCl_3$ exts. are washed with 5% NaOH (15 ml.), dried (Na_2SO_4), and evapd. The solid residue is treated with 5 ml. of concd. H_2SO_4-fuming HNO_3 at 100°, dild., and extd. with benzene. The benzene ext. gives a blue or green color with *N*-KOH-ethanol at the interface; the method will detect 1 mg. of DDT per kg. in a sample of 20 g. of flour.

Development of an efficient analytical record system.

HALE, A. H., AND STILLMAN, J. W. *Anal. Chem., 24,* 143 (1952).

One of the most important factors in the successful operation of an industrial analytical lab. is an adequate system of keeping records of samples being analyzed and of the data obtained. The system described has been developed to meet this need and is in actual use in several industrial labs. Printed slips with interleaved carbons are used for recording and reporting analytical data. Printed punch cards are also used, first to provide positive control of the progress of the analysis and then to locate original data on the report slips in the permanent file. The system is sufficiently flexible to be useful in large or small labs. handling a wide variety of analytical work. It is convenient and time-saving for analysts and supervisors, eliminates much handwriting, and gives information leading to improvement of analytical organization helpful in compilation of operational reports.

BIOLOGICAL SCIENCES

BIOCHEMISTRY

The biological transformation of galactose into glucose.

TOPPER, Y. J., AND STETTEN, D. *J. Biol. Chem., 193,* 149 (1951).

D-Galactose-1-C^{14} has been synthesized and administered by stomach tube to fasted rats. Over 50% of the glycogen re-

(Continued on page 18 following technical papers)

[a] These Selected Abstracts are made available to FOOD TECHNOLOGY through the cooperation of Associate Editor H. A. Campbell and the General Foods Corporation of New York, N. Y. The abbreviations found in these abstracts are similar to those used by Chemical Abstracts.

How to Pinch a Pea!

This machine, the Tenderometer, was developed by a Canco technologist to find the answer to an important question: "How tender is a pea?"

In enabling growers to determine the exact degree of maturity of the growing pea, there is a much narrower margin for error in the control of labor, equipment, and flow of crop to the canner. When only *ripe* peas come to the canner, and on a predictable schedule—only *perfect* peas go to his customers.

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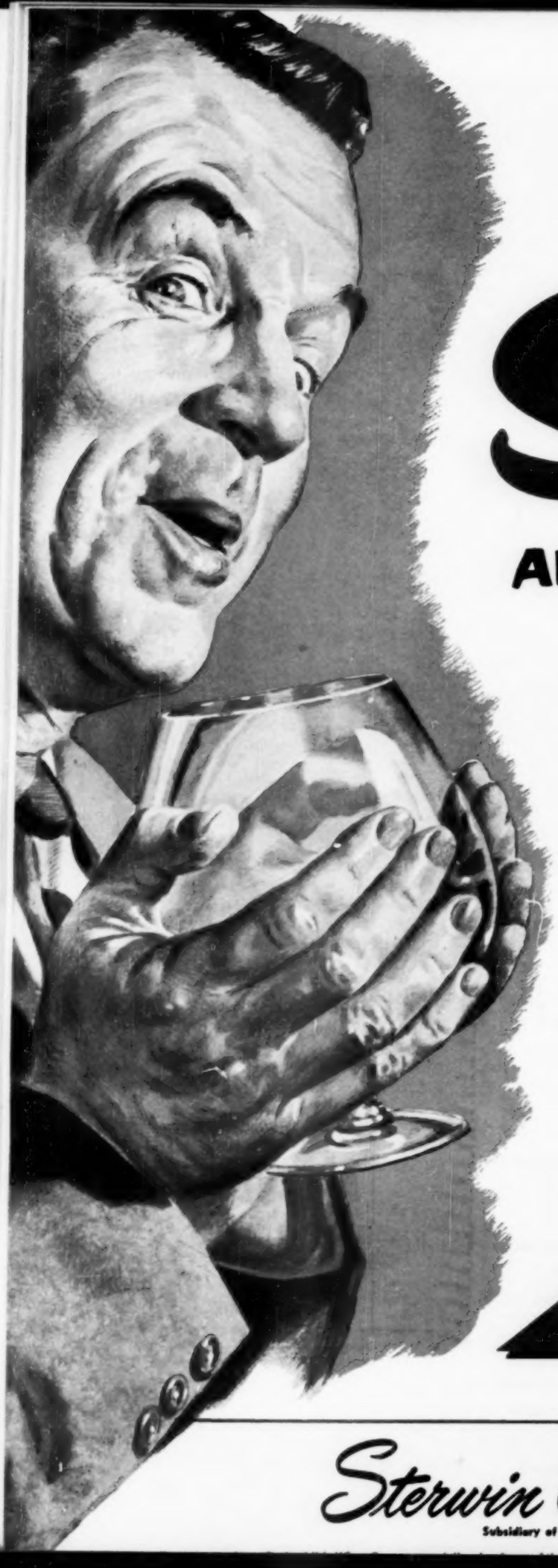

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THE TECHNOLOGIST KNOWS HE MUST HAVE CHECKS and CHECKS and CHEX

For Safety's Sake

ATI COOK·CHEX

QUALITY CONTROL TAGS

Your recording thermometer and pressure charts give you complete and accurate information on *how* the retort has been mechanically operated. But only ATI Cook-Chex can provide exact information on specific conditions throughout the retort—cold spots, air pockets—at the spot where your cooking actually is done. ATI Cook-Chex turn from purple to green only under the combined action of steam, temperature, and time.

HERE ARE REPLICA ATI COOK-CHEX TAGS. THESE WILL CHANGE FROM PURPLE TO GREEN IN YOUR RETORT IN APPROXIMATELY 15 MINUTES AT 250° F.

ATI Cook-Chex will *fail* to turn from purple to green under *exactly the same conditions* that cause blown cans or flat sours. With ATI Cook-Chex on each basket in the retort, the possibility of such spoilage is definitely checked. Any partial or incomplete change from purple to green is a red danger flag.

The standard ALL-PURPOSE ATI Cook-Chex turn from purple to green in approximately 15 minutes at 250° F. in your retort. They will not react to any other than retort conditions. They are not affected either inside or outside the retort by water or heat alone. Their complete reaction from purple to green indicates positively that the baskets to which they are attached, have been through the retorting process and not by-passed.

If you wish an accurate check on any specific process, our SPECIAL PROCESS ATI Cook-Chex are timed to react only after exposure to the time and temperature of that specific process. For example, on a 50-minute 250° F. process, your SPECIAL PROCESS ATI Cook-Chex will be definitely green in 50 minutes at that temperature.

Use ALL-PURPOSE ATI Cook-Chex to insure against the possibility of a basket by-passing the retort. The ATI Cook-Chex tag will not turn green unless it has been through the retort.

The SPECIAL PROCESS ATI Cook-Chex give you this insurance plus the added assurance that the basket has been in the retort for the correct length of time and at the right temperature. The spoilage savings effected by ATI Cook-Chex will in every case far out-weigh their insignificant cost. Here is assured protection for a fraction of a cent per case.

LOOKING PROVES COOKING

JOIN THESE IMPORTANT USERS OF ATI COOK·CHEX

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Only ATI COOK·CHEX OFFER ALL THESE ADVANTAGES

The primary objective of retort processing is the destruction of spoilage bacteria. Local air pockets with correspondingly lower temperatures will retard or prevent this bacterial destruction.

Temperature alone is not enough. *Moist* heat is absolutely required. Spoilage bacteria may survive for hours in dry heat. Even a small amount of residual air will retard their destruction.

The human body recognizes the effect of moist heat—80° F. with low humidity is not at all uncomfortable, but with high humidity it is intolerable. "It ain't just the heat, it's the humidity."

Lower temperature or traces of residual air retard the ATI Cook-Chex reaction time to almost exactly the same degree that these factors retard bacterial destruction.

The recording thermometer and pressure charts indicate retort operational conditions only. ATI Cook-Chex indicate the extent of bacterial destruction. ATI Cook-Chex do not replace the thermometer and pressure gauge—they complement them.

THIS SIMPLE FLOW CHART SHOWS HOW YOU CAN INSURE COOKING CERTAINTY WITH ATI COOK·CHEX

STEP A. FILLING SECTION
Store ATI Cook-Chex tags on hooks at Filling Section. Place one tag in tag-holder on each basket.

STEP B. LOADING THE RETORT
After basket is loaded, retort operator checks tag as correct for process, and writes Batch and Retort numbers in spaces provided. Basket is then run into retort.

STEP C. UNLOADING THE RETORT
Retort operator examines tag for proper color change as basket is removed from retort after processing. If color change is O.K., he initials tag. If completely or partially unchanged, he diverts basket to Laboratory for testing.

STEP D. LABELING AREA
After cooking, basket goes to labeling or storage area. Tag is inspected again. If color spot is green, tag is removed and placed on hook. If color change is not complete, Quality Control is notified. NOTE: ATI Cook-Chex insure instant spot checks at any point in your production process.

STEP E. FILED FOR REFERENCE
All ATI Cook-Chex tags are collected as baskets are emptied. They are bundled, dated and filed for permanent record.

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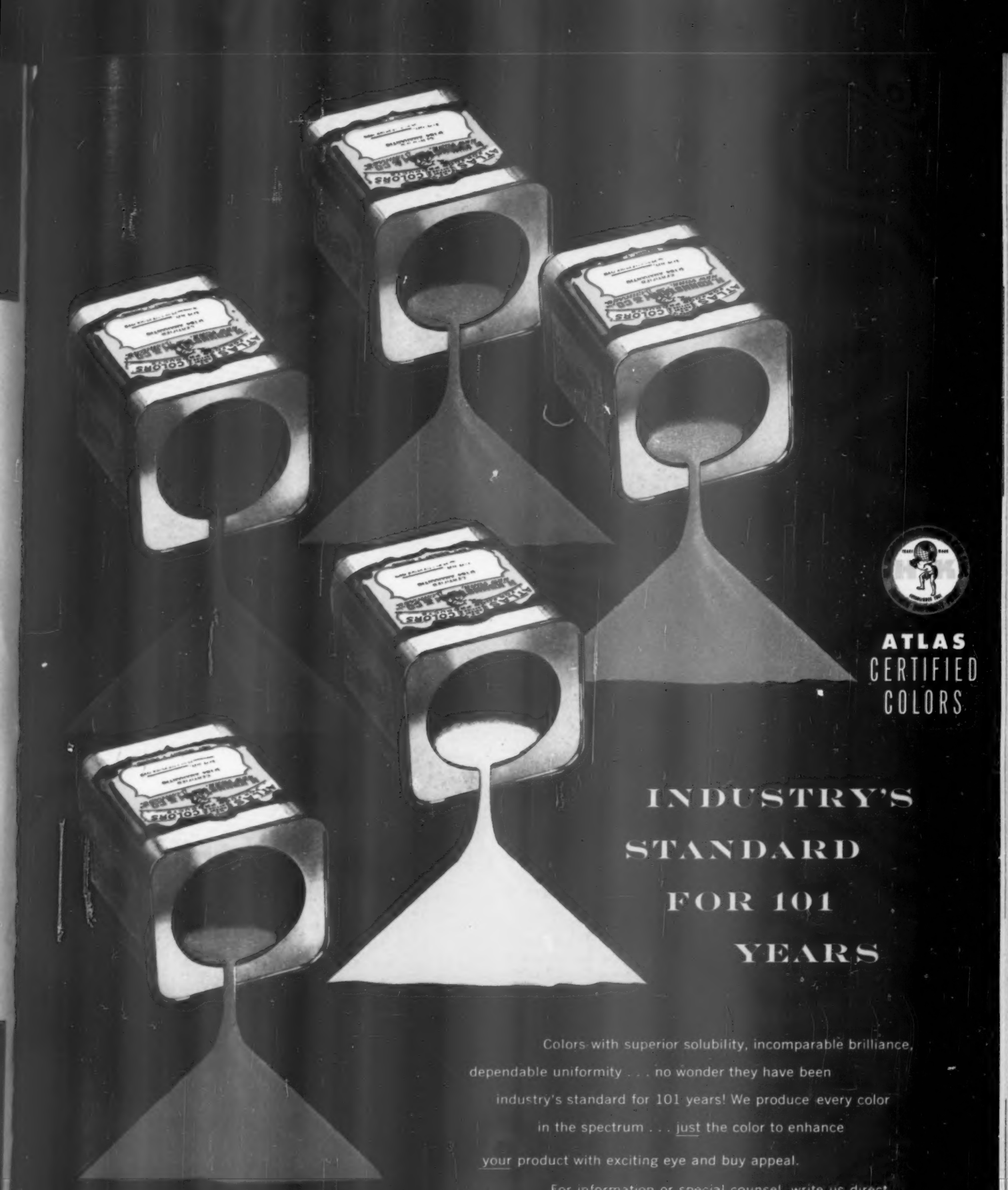

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BRANCHES IN OTHER PRINCIPAL CITIES OF THE U. S. A. AND THROUGHOUT THE WORLD

Abstracts

(Continued from page 12 preceding technical papers)

covered from their livers after 3 hours was shown to have arisen from fed galactose, and about 90% of the isotope in this glycogen was shown to reside in position 1 of the glucose obtained on hydrolysis. These results are taken to indicate that the biol. transformation of D-galactose to D-glucose proceeds via a direct epimerization at carbon atom 4 without rupture of the carbon skeleton.

Degradation of amylopectin to panose.

THOMPSON, A., AND WOLFROM, M. L. *J. Am. Chem. Soc., 73,* 5849 (1951).

By the use of a combination of carbon and silicate chromatography a trisaccharide, 4-α-isomaltopyranosyl-D-glucose or panose, has been isolated as its cryst. glycitol dodecaacetate from a reduced acid hydrolyzate of amylopectin. The isolation of panose, which contains one α-1, 6-link, from this hydrolyzate constitutes further evidence for the conception that branching occurs at the 6 position of D-glucose in the amylopectin mol.

Effect of protein depletion on rate of disappearance of radioactive protein from the blood stream.

HUBAY, C. A., KRIEGER, H., HOLDEN, W. D., AND HANCOCK, I. *Proc. Soc. Exptl. Biol. Med., 78,* 402 (1951).

Plasma volumes can be accurately detd. by the radioactive (I-131) iodinated plasma protein method in nutritional hypoproteinemia. The rate of disappearance of radioactive protein from the blood stream is the same in undernourished states as in normal and therefore cannot be utilized to det. the state of the protein reserves of the body. In patients who are losing abnormal amts. of protein in the urine or into abscess cavities, the rate of disappearance appears to be increased. The use of radioactive serum albumin may offer a diagnostic aid in the detection of unexplained protein losses.

The chemistry of vegetable tannins.

QUEBRACHO, I. *J. Am. Leather Chemists Assoc., 46,* 613 (1951).

Comprehensive treatise on chemistry of tannins including, analyses, mol. wts., solubilities, methylation, acetylation, and oxidation as well as speculative structures.

Toxicologic studies on synthetic glycerol.

HINE, C. H., ANDERSON, H. H., AND MORSE, M. *J. Pharmacol. Exptl. Therap., 103,* 347 (1951).

Toxicologic studies have been carried out on synthetic (commercially available product prepd. from propylene) and natural (USP) glycerine. Chronic feeding expts. were carried out in Long-Evans rats and dogs. The glycerines were added to the diet in quantities of 5, 10, and 20% by wt. Hematologic studies and urine analyses were conducted at 6-month intervals. The animals receiving the 20% glycerine diets were sacrificed after one year. There were no significant differences in mortality, growth curves, organ/body wt. ratios, fat and glycogen contents of the liver or histopathology of various tissues between the groups of rats receiving the two glycerines.

Effect of trichloroethylene on the organism.

AHLMARK, A., AND FORSSMAN, S. *Acta Physiol. Scand., 22,* 326 (1951); *Chem. Abstracts, 46,* 635e (1952).

Trichloroethylene (I) acts as a typical inhalation narcotic. Its inhalation by man or animal leads to excretion of CCl_3COOH (II) in urine and feces (about ⅔ in the urine and insignificant amts. in feces). About 6-16% of the absorbed substance appears in the urine as II. Rats injected subcutaneously with the Na salt of II (equiv. to 1 g. II per kg.) manifest no signs of poisoning, although the urinary concn. of the II may reach 7900 mg. per l.

BOTANY

Cytogenetical responses of cereals to 2,4-D. I. Study of meiosis of plants treated at various stages of growth.

UNRAU, J., AND LARTER, E. N. *Can. J. Research, C, 30,* 22 (1952).

Different plots of Olli barley, Thatcher common wheat, and Stewart durum wheat were each sprayed with a single treatment of 2, 4-D. The spraying was done at 3-day intervals from emergence to heading time in order to study the effect of the herbicide when applied to plants at various developmental stages. An ester formulation equiv. to 12 ounces of acid in 40 gal. of water per acre was used in all cases. Meiosis was studied in spikes obtained from plants of treated and untreated check plots. This material was fixed and stored in Carnoy's Fluid A. Meiotic irregularities were induced by the treatment in some plants of each of the three cereals at all stages of growth. The percentages of abnormal metaphases and anaphases ranged from 0.0 to 35.3 in barley, 0.0 to 33.3 in durum wheat, and 0.0 to 25.0 in common wheat. Chromosomal aberrations were of various types including bridges, fragmentation, asynapis, aneuploidy, polyploidy, chain and ring formation, and in many cases extreme stickiness of chromosomes. These aberrations are similar to those induced by X irradiation or other mutagens. It is important to det. whether chromosomal aberrations in treated plants are transmissible and also whether gene mutations have been induced. Cytogenetical studies are under way on progenies of treated plants.

Rutin content of Sophora japonica L.

COUCH, J. F., MAGHSKI, J., AND KREWSON, C. F. *J. Am. Chem. Soc., 74,* 424 (1952).

Unopened flower buds of the Chinese Scholar tree are used for medicinal purposes in China under the name "Wai Fa," the "blossom of the tree." This material contains 4 to 5 times as much rutin as does buckwheat, our best domestic source of that glycoside.

Chemical weed control.

TEMPLEMAN, W. G. *Mfg. Chemist, 23,* 8 (1952).

Review and evaluation of selective weedkillers, mixed weedkillers, herbicide-fertilizer mixts. and pre-emergence weedkillers used in the past 12 years.

MICROBIOLOGY

Influence of temperature upon radiation sensitivity of thermophilic and mesophilic bacteria.

MEFFERD, R. B., AND CAMPBELL, JR., L. L. *Proc. Soc. Exptl. Biol., Med., 79,* 12 (1952).

Temp. and atm. exert an influence on the effects produced by ultraviolet irradiation even in the spore stage. The thermophile was more sensitive to the lethal action of ultraviolet radiation but was less affected by changes in temp. during irradiation in air. In the absence of oxygen from the suspension, temp. exerted almost no effect on the thermophile but the mesophile was markedly affected. This would be expected if the thermophile possessed heat-stable nuclear proteins and damage due to radiation were not additive to that from heat denaturation. Generally the thermophile was much less mutabile than the mesophile as compared by streptomycin resistant, fermentation and biochemical mutants.

New coating agent promises mold-free surfaces.

HERMAN, L. G., AND REED, C. L. *Food Eng., 24,* 71 (1952).

Mold inhibiting ability of copper-8-quinolinolate formulated into paints. Cites possibilities in other impregnating materials.

NUTRITION

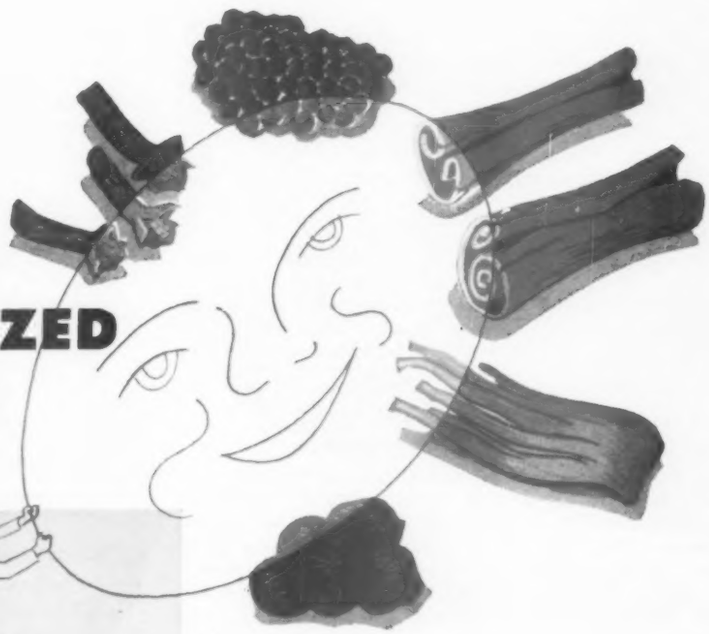
The amino acid requirements of man. III. The role of isoleucine; additional evidence concerning histidine.

ROSE, W. C., HAINES, W. J., AND WARNER, D. T. *J. Biol. Chem., 193,* 605 (1951).

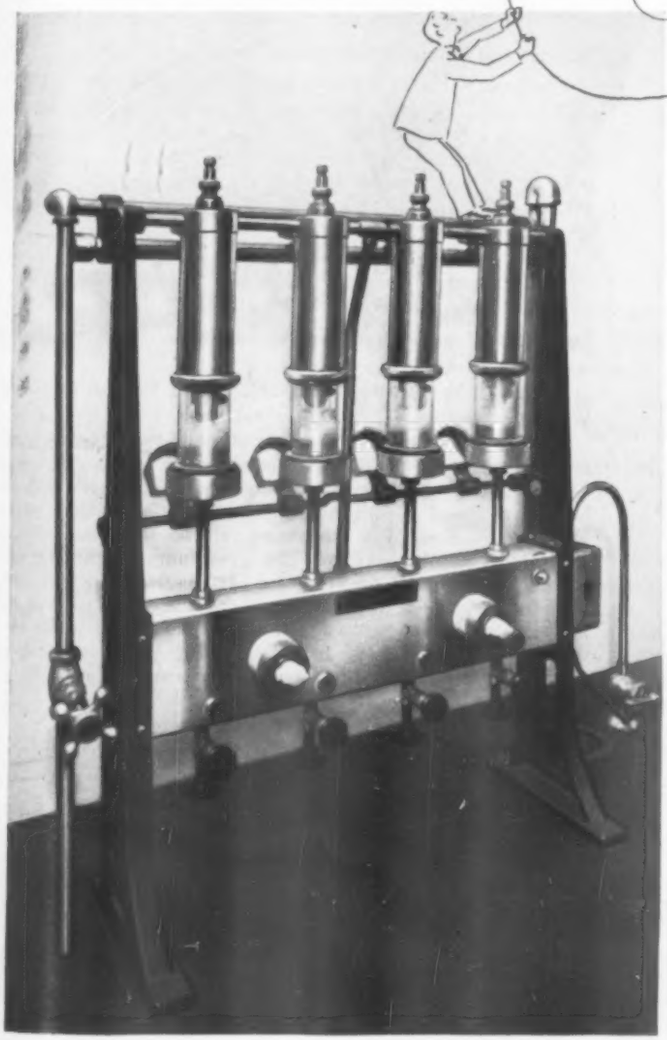
Further expts. designed to establish the amino acid requirements of man have demonstrated that isoleucine, leucine, and phenylalanine are indispensable dietary components and that preformed histidine is not necessary for the maintenance of nitrogen equil. in adult man.

(Continued on page 20)

How Griffith's Two-Phase Extraction Process* Assures Better-Flavored Products



PEPPEROYAL AND SOLUBLIZED SEASONINGS



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The Taste of Sunshine all the Time

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Abstracts

(Continued from page 18)

The amino acid requirements of man.

ROSE, W. C., WARNER, D. T., AND HAINES, W. J. *J. Biol. Chem., 193,* 613 (1951).

Adult human subjects may be brought into N equil. upon diets in which 94% of the total N is furnished by a mixt. of the 9 amino acids, other than histidine, which were previously found to be essential for the growing rat. The removal of either leucine or phenylalanine from this ration, without alteration in the total N intake, leads to a negative N balance which is relieved by the restoration of the missing amino acid. The findings demonstrate clearly that leucine and phenylalanine are indispensable components of the diet of man.

A study of the minimum calcium requirements of adult men.

HEGSTED, D. M., MOSCOSO, I., AND COLLAZOS, C. *J. Nutrition, 46,* 181 (1952).

Calcium excretions were studied in 10 adult male volunteers at several levels of calcium intake. The av. estd. calcium requirement to maintain balance in these men was between 100 and 200 mg. per day, depending on the method of calcn. Evidence is presented that the maintenance requirement is related to calcium reserves.

Growth on cereal and milk diet.

BEINERT, F. L. *J. Home Econ., 44,* 119 (1952).

A diet of milk or of cereals fed alone, provided ad libitum to young rats, does not support either normal growth or development as demonstrated by wt. gain, increase in body length, and bone ash detn. These foods no more than any other single food can alone supply adequate amts. of all essential nutrients. Cereals and milk, however, when fed together, mutually complement each other's nutrient contributions in such degree as will promote optimal gain in wt. and stature according to accepted standards.

Induced cobalt deficiency in lambs.

STEWART, J. *Brit. J. Nutrition, 5,* 320 (1951).

In-lamb ewes were fed a diet of 1100 g. flaked maize, 250 g. hay, and 60 g. mineral mixt. daily for the last 3 months of pregnancy. This diet allowed of a daily ingestion of 0.0687 mg. cobalt. Their lambs when weaned at 10 weeks of age were given 800 g. flaked maize, 80 g. hay, 25 g. mineral mixt. daily (0.0347 mg. cobalt), increasing steadily to the quantities in the ewe's diet at 16 weeks of age. These lambs all eventually showed the clinical signs of cobalt deficiency but made immediate dramatic response if fed 10 mg. cobalt per week.

The effect of vitamin B_{12} on reproduction and lactation in rats receiving pork or beef diets.

MEYER, M. L., THOMPSON, H. T., AND ELVEHJEM, C. A. *J. Nutrition, 45,* 551 (1951).

Oral supplements of cryst. vitamin B_{12} at the 0.1 γ per day level did not overcome the lactation failure frequently seen in rats fed roast pork as the sole source of protein, but did help in overcoming the conception lag often accompanying such a diet. The failure of vitamin B_{12} did not seem to be due to poor absorption as injected vitamin B_{12} did not produce an improvement. Substitution of dextrin for sucrose caused lactation failure in every group. Addn. of 5 mg. % streptomycin did not produce any improvement in the lactation of the pork fed animals.

Pigs raised like chicks.

Science News Letter, 60, 341 (1951).

Motherless pigs have been successfully raised on a synthetic sow's milk made of dry skim milk, lard, fish solubles, vitamins, and minerals, and fortified with terramycin. When weaned from the synthetic milk diet, at 8 weeks of age, the pigs are 10% to 35% heavier than the sow-fed animals. The feeding was done from troughs.

Nutritional status of aging.

CHOPE, H. D., AND DRAY, S. *Calif. Med., 74,* 105 (1951); *Brit. Abstracts, AIII,* 1235 (1951).

A preliminary report is made on the examn. of 577 persons of 50 years old and over. Findings are given regarding clinical status, the incidence of anaemia, glycosuria, hyperglycaemia, and blood ascorbic acid content.

Nutrition and the pure food laws.

Brit. J. Nutrition, 5, 363 (1951).

Symposium in nutrition and the pure food laws (Great Britain) including: historical aspects of the pure food laws; recent advances in food legislation for the protection of the consumer; problems in the administration of the laws relating to the food of men and animals; and the toxicological aspects of food adulteration, chem. additives and adulterants in food.

ENGINEERING

Distillation in a multitube wetted wall column.

LINDSEY, E. E., KIEFER, J. M., AND HUFFINE, C. L. *Ind. Eng. Chem., 44,* 225 (1952).

Expts. made with a column utilizing the outer surfaces of 7 parallel tubes as wetted walls and using the systems methanol-water and trichloro-ethylene-toluene show that the wetted wall column is somewhat less efficient than an equivalent packed column at any but the lowest reflux ratios, although the pressure drop through the column is considerably less. This is contrary to the results expected from studies of single tube wetted wall rectification columns. It is concluded that the multitube column is of industrial importance primarily in application such as vacuum distn. where pressure drop is of considerable importance.

New method of sterilizing canned foods.

BENJAMIN, H. A. *Canning Trade, 74,* 9, November 19, 1951.

A discussion of current methods of heat sterilization and sterilizations without heat. The latter type involves the use of antibiotics, cathode and gamma rays and atomic energy. It is pointed out that none of the latter methods appear to be developed to the point of industrial application at the present time.

FOOD TECHNOLOGY

BAKERY PRODUCTS

The effect of particle size on the nutritional characteristics of unifine flour.

STEVENS, M. C., SIEBURTH, J. F., WAHL, T., AND MCLAREN, B. *Food Research, 17,* 74 (1952).

The finer grind of Unifine has changed the baking characteristics and some of the phys. properties of whole wheat flour. Growth studies with rats have shown that Unifine resulted in a better growth at a 10% level of protein than a com. whole wheat flour. These data brought up the question of whether the digestibility of the flour and the availability of the nutrients were increased due to the decreased particle size. However, using nitrogen and crude fiber methods to det. the extent of digestion in the rats, the coarser whole wheat flour seemed to be more digestible than the finer; and thiamine, chosen as indicator of the B vitamins, appeared to be equally available in flours of several degrees of fineness.

FATS AND OILS

Soybean oil off-flavor removed by new method.

Science News Letter, 61, 54 (1952).

U. S. Dept. of Agriculture scientists have developed a permanent method of removing off-flavors from soybean oil. The flavor, caused by the presence of highly unsatd. linolenic acid, is removed in the lab. by satg. only the linolenic acid. Work is now in progress for satisfactory com. methods.

The flavor problem of soybean oil. X. Effects of processing on metallic content of soybean oil.

(Continued on page 22)

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Abstracts

(Continued from page 20)

EVANS, C. D., COONEY, P. M., MOSER, H. A., HALLEY, J. E. AND MELVIN, E. H. *J. Am. Oil Chemists' Soc., 29,* 61 (1952).

"Native" content of iron in crude soybean oil was approx. 0.8 p.p.m., and the copper content was about 0.4 p.p.m. Com. extn. increased the iron content of crude oil 4- to 8-fold; passage through each of the unit operations increased the iron content. Deodorization is the processing step in which the improvements most logically could be made on both the quality and stability of soybean oil. A reduction of the metal contamination and the use of a metal scavenger will improve both the quality and stability of soybean oil.

Processing procedure and flavor stability in soybean oil.

LIPS, H. J., GRACE, N. H., AND ZIEGLER, J. A. *Can. J. Research, F, 30,* 1 (1952).

Chem. and phys. measurements and small scale taste panel tests on lab. refined American and Canadian solvent extd. soybean oils indicated that their quality was generally similar. Flavor stability was not improved by deodorization in the presence of citric acid, increased deodorization time, treatment with activated magnesia, preliminary treatment with concd. hydrochloric acid, or by refining in miscella with or without subsequent addn. of butylated hydroxyanisole.

Effects of electronic irradiation on fats.

HANNAN, R. S., AND BOAG, J. W. *Nature, 169,* 152 (1952).

Samples of fats were irradiated in the electron beam from a Van der Graaf generator and the intensity noted. The peroxide member of the fats was dependent on the temp. of the sample during irradiation. The value increasing with a decrease in temp. Antioxidants are destroyed in butter fat by irradiation and slowing at high temp. The addn. of antioxidants prior to irradiation prevents peroxide formation in fats and fatty esters.

The antioxidant behavior of the isomers of butylated hydroxyanisole.

DUGAN, L. R., HOFFERT, E., BLUMER, G. P., DABKIEWICZ, I., AND KRAYBILL, H. R. *J. Am. Oil Chemists' Soc., 28,* 493 (1951).

The antioxidant effectiveness of the purified isomers of BHA and prepd. mixts. of these isomers was studied in 11 lards. The 3-isomer is more effective in providing AOM stability than the 2-isomer, and the mixts. of isomers fall between the purified isomers in antioxidant effectiveness. The commercially prepd. BHAs were compared in a number of different lards. No significant advantage could be ascribed to one over the other although the compn. in terms of relative proportions of the isomers of BHA may be somewhat different.

FISH AND SEAFOOD

Freezing fish at sea.

LANTZ, A. W., AND CARTER, N. M. *Fishing Gaz., 69, 37* (1952).

Includes table giving results of taste tests comparing halibut frozen in the fishing boat and halibut stored in ice on the boat.

FRUIT, FRUIT JUICES AND VEGETABLES

Hormone spray keeps lemons fresh in storage.

Science News Letter, 61, 46 (1952).

Spraying lemons with 2, 4-D or 2, 4, 5-T before storage keeps the stem end, or button, alive and prevents internal changes which accompany aging of the fruit.

Storage of fruits for canning.

ATKINSON, F. E., AND STRACHAN, C. C. Can. Dept. Agr. Expt. Farms Serv., Dominion Exp. Sta. Prog. Report. 1937-1948, 56 (1951); *Refrig. Abstracts, 7,* 17 (1952).

Apricots, peaches, and prunes held at 31-32° F. for 3 weeks have made satisfactory canned products. Bartlett pears picked at the proper maturity and stored within 24 hr. at 30-31° F. have been held in good condition for 60 days but com. storage should not be relied upon after 45 days. Peaches should be ripened at 70-75° F. until almost ready for canning before being placed in storage at 31-32° F. This overcomes the difficulty in removing skin and pit and improves the flavor.

Fatty acids from freshly canned Florida Valencia orange juice.

SWIFT, L. J. *Food Research, 17,* 8 (1952).

An analysis of the methyl esters of the fatty acids of freshly-canned Florida Valencia orange juice has been completed. From the unsatd. acids found it is evident that there is ample opportunity for oxidative rancidity changes to take place and it is possible that these are the origin of the flavor deterioration. Since there appears to be no short-chain fatty acids present, it is not likely that hydrolysis of the lipid plays any major part in the flavor changes as far as the acids are concerned.

Some observations on the malo-lactic fermentation of cider.

MARSHALL, C. R. *J. Sci. Food Agr., 3,* 91 (1952).

Ciders are prone to a malo-lactic fermentation which can be beneficial in reducing the acidity of sharp juices, but which may cause spoilage in sub-acid juices. A method is described for the estn. of malic acid in cider which is useful for following both the decrease in malic acid content during fermentation and also for observing changes in the malo-lactic index. The latter is the ratio of calcd. free acidity to observed free acidity at any stage in the fermentation and it should remain const. throughout the full course of fermentation and maturation of a normal sound cider. It decreases in value when acid spoilage occurs through the development of undesirable organisms and enables the malefic influence of these organisms to be detected before any increase in acidity becomes apparent. The malo-lactic fermentation can be retarded in the presence of sulphites and may be completely arrested if the cider is centrifuged before sulphiting.

The ascorbic acid content of potato tubers. II. The influence of the temperature of storage.

BARKER, J., AND MAPSON, L. W. *New Phytologist, 49,* 283 (1950); *Biol. Abstracts, 26,* 53, No. 497 (1952).

Previous workers have usually reported a more rapid loss of ascorbic acid in potatoes transferred to low temps. than in tubers held at 10° C. Recently, however, an addnl. effect has been observed, an initial increase in ascorbic acid at low temps., which precedes the decrease. This work confirms these findings and demonstrates a complicated relationship between ascorbic acid content, temp., developmental state of the tuber, and physiol. breakdown. With potatoes previously stored for some months at 10° C., an increase in ascorbic acid was also observed when the temp. was raised to 25° C. No evidence was obtained from chem. tests that the reducing substance, estd. by indophenol, was not ascorbic acid.

The effect of preharvest foliar sprays of maleic hydrazide on sprout inhibition and storage quality of potatoes.

PATTERSON, D. R. *Plant Physiol., 27,* 135 (1952).

Maleic hydrazide was more effective in the inhibition of potato sprouts than 2, 4, 5-trichlorophenoxyacetic acid or the methyl ester of alpha-naphthaleneacetic acid. In the treatment of preharvest foliar, sprays up to 2500 p.p.m. were applied to the foliage of Irish cobbler and Pontiac potato vines about 7 weeks prior to harvest and the tubers were held in storage for 7 months at 45° F. and 55° F. The maleic hydrazide treatment also presented some degradation of starch to sugar.

MILK AND MILK PRODUCTS

Stability of milk and its concentrates in frozen storage of various temperatures.

BELL, R. W., AND MUCHA, T. J. *J. Dairy Sci., 35,* 1 (1952).

Temp. range for storing frozen milk and its concentrate up to 45% solids is about —10° to —20° F. The greater the concn. of solids up to a 4 to 1 product the less susceptible a milk is during frozen storage to development of oxidized flavor and

(Continued on page 25)

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Abstracts

(Continued from page 22)

the less beneficial is fortification with ascorbic acid. Retention of fresh milk flavor is the limiting factor in the preservation in a frozen state of milk and its concentrates up to 45% solids.

Some properties of freeze-dried milk.

NICKERSON, T. A., COULTER, S. T., AND JENNESS, R. *J. Dairy Sci., 35,* 77 (1952).

The effect of freeze drying milk on the phys. state of certain milk constituents and on keeping qualities of the resulting powder has been studied and compared with spray dried milk. Freeze drying by the methods used does not produce a more satisfactory product than spray drying.

The effect of heat treatment on the nutritive value of milk proteins.

KRAFT, R. A., AND MORGAN, A. F. *J. Nutrition, 45,* 567 (1951).

Three samples of dry skim milk supposedly processed at different temps. were found to have similar solubilities and identical protein efficiencies for the growth of young dogs. After 56 days, two of the dogs were fed a diet contg. milk autoclaved 15 minutes at 118° C., but again no striking changes in growth, appetite, nitrogen retention, or serum protein resulted. Two of the unheated milk samples and one autoclaved for 15 or 25 minutes at 120° C. were then fed at a 12% protein level to groups of rats, alone and supplemented by lysine, methionine, valine or all of these amino acids at the 1% level. The milk autoclaved for 15 minutes lost from ½ to ⅔ of its growth efficiency but this was largely restored by the lysine or lysine, methionine and valine supplement. The sample autoclaved for 25 minutes did not support growth except when lysine-supplemented.

STARCH

Effect of various physical treatments upon the amyloclastic susceptibility of starch.

VOLZ, F. E., AND RAMSTAD, P. E. *Food Research, 17,* 81-92 (1952).

A method for measuring the susceptibility of starch to attack by taka-diastase was used to observe the extent of gelatinization and retrogradation caused by various phys. treatments and storage conditions. Marked increases in amyloclastic susceptibility were caused by phys. damage to starch granules and by heating in the presence of water to gelatinization temps. Some increase resulted from drying of gelatinized pastes under certain conditions. At high ratios of starch to water, lack of sufficient water for complete gelatinization limited the extent of enzymatic susceptibility produced by heating. Pastes of gelatinized starch showed varying tendencies to loss of amyloclastic susceptibility as a consequence of retrogradation depending upon the type of starch and the treatments they received. Waxy maize starch showed less change than did either corn or potato starches. Loss of enzymatic susceptibility following freezing and thawing of pastes was found to be inversely proportional to the rates at which the freezing and thawing processes took place. That is, rapid freezing and thawing caused the least change. Storage at —18° C. for 8 months was without discernible effect. The procedure used is adaptable with slight modification, to the study of changes in the starch fraction of bread, potatoes, and other foods.

ORGANIC CHEMISTRY

Theory and practice of ion exchange.

WARREN, R. M. *Nature, 169,* 22 (1952).

A symposium. Papers by A. L. Lister and by J. D. H. Strickland dealt with use in assessing cation-anion complexing of some metals. Paper by S. M. Partridge on "The Use of Ion Exchangers in Organic Chemistry" described both the displacement and elution technics as applied to amino acids and proteins. Rate of equilibration of proteins with ion exchangers comparable with that of amino acids. Other papers dealt with prepn., behavior, kinetics, and theory of ion exchangers.

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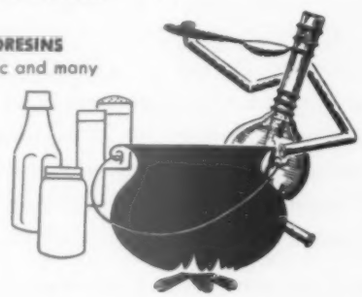

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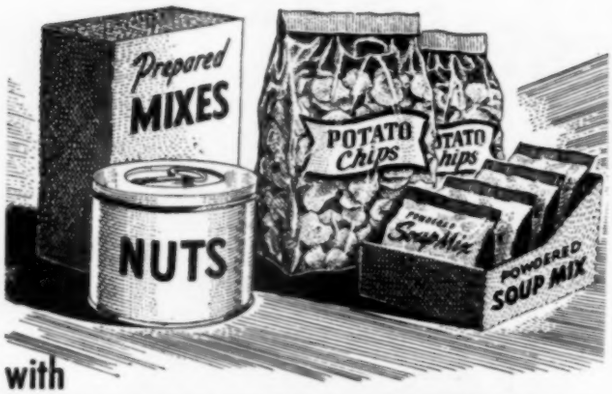

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DIAMOND CRYSTAL
Antioxidant SALT

Abstracts

PACKAGING

Evaluating case fatigue.

Zusi, C. J. *Modern Packaging, 25,* 129 (1952).

A method is presented for evaluating the fatigue factor of cases in relation to permissible warehouse stacking heights. Wide variations are encountered in the testing of replicate samples. Principle factors causing variation are thought to be humidity and the efficiency of box fabrication.

Flexing test device.

Gelber, P. A., and Bowen, Jr., J. H. *Modern Packaging, 25,* 125 (1952).

A description of the Gelbo instrument which predicts performance of barrier materials under application and use conditions. The instrument simultaneously creases and flexes a sheet material under standard, reproducible conditions. WVTR of flexed specimens is subsequently detd. Exptl. data are included.

WAXES AND DETERGENTS

Petroleum waxes; their use and evaluation for paper packaging.

Thorpe, T. C. G. *J. Inst. Petroleum, 37* (330), *275* (1951); *Packaging Abstracts, 8,* No. *2763* (1951).

The different types of petroleum waxes and their uses in paper packaging are reviewed. The most important methods of applying wax, by paper waxing, carton waxing, milk-carton waxing, laminating and paper sizing, are described. Also 21 properties of petroleum wax are discussed and in the case of the 15 most important properties, current methods of evaluating them and current thoughts on correlating the results of such measurements with service performance are indicated.

Silicone water-repellents for general use in the laboratory.

Gilbert, Jr., P. T. *Science, 114,* 637 (1951).

A discussion of the application of water-repellent silicone films of mol. thinness to lab. glassware and other app. Water-repellent silicone coatings have been found invaluable in speeding the use and enhancing the precision of pipettes, burettes, and other volumetric ware, by making drainage complete and eliminating rinsing, washing, and drying. On beakers, flasks, and other analytical app., the coatings similarly simplify operations and improve analytical accuracy. Addnl. uses are found in absorption spectrophotometry, flame photometry, ciscometry, electrochemical pH measurement, and the handling of blood.

PATENTS (U. S. A.)

Method for preventing deterioration of seeds.

Condon, M. Z., and Lambou, M. G. Assignors to U. S. A. *2,584,972,* February 12, 1952.

A process for preventing deterioration of seed due to enzyme activity comprising spraying seed, contg. natural enzymes and having a moisture content up to about 30%, with a liquid halohydrin in a concn. of 0.2 to 1.0%, calcd. on a dry wt. basis of the seed, to bring the enzymes present in the seed into chem. contact with the halohydrin.

Process for preparing fruit sauce products.

Rooker, W. A. Assignor to H. F. Byrd, Inc. *2,582,396,* January 15, 1952.

A process for prepg. fruit sauces from fruit having a pH less than 4 which comprises cooking a portion of the fruit to form a hot cooked, sterile sauce, comminuting a portion of the fruit into a raw pulp, admixing raw fruit pulp with hot, cooked, sterile fruit sauce in such proportion that raw pulp is heat-sterilized by hot, cooked sauce, mixt. substantially retaining the aromatic constituents present in the raw fruit component.

Electronic cooking.

Spencer, P. L. Assignor to Raytheon Manufacturing Co. *2,582,174,* January 8, 1952.

The method of producing a toasted surface on a food body comprising coating the surface of body with an edible substance which absorbs microwave energy more readily than body, and subjecting body to microwave energy for a sufficient length of time to toast coating.

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FUTURE DATES FOR FOOD TECHNOLOGIST

August 4-8	Food and Nutrition sessions, Gordon Resea Conferences, AAAS, New London, N. H.
Sept. 9-13	Seventh National Chemical Exposition, AC Coliseum, Chicago, Ill.
Sept. 29-Oct. 1	Association of Official Agricultural Chemi Annual Meeting, Shoreham Hotel, Washi ton, D. C.
Oct. 20-22	Fall Meeting, American Oil Chemists' Soci Cincinnati, Ohio.
Dec. 28-31	119th Meeting, American Association for Advancement of Science, St. Louis, Mo.
	1953
June	**Institute of Food Technologists, Thirtee Annual Meeting, Boston, Mass.**

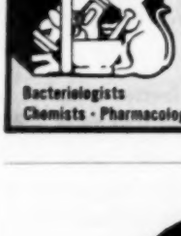
(Information concerning future dates of national and internati meetings, conventions and exhibits of interest to food technologists sh be sent to the editorial office.)

ATLANTIC COAST MACKEREL PURSE SEIN

The method of fishing and style of purse seiners us in the mackerel fishery on the East Coast probabl originated from the Mediterranean type, except that t operation has been mechanized and some improvemen and modifications have been made in the vessels a gear. Improvements in mackerel fishing methods a gear continue to be made, but they differ somewh among the individual vessels and different localities.

Fishery Leaflet 373, *Atlantic Coast Mackerel Pur Seine*, describes the operation and construction of t Atlantic Coast mackerel purse seiner. Detailed sketch of the gear and vessels used are included.

Records show that between 1815 and 1860 t mackerel fishery on the East Coast was essentially hook-and-line fishery, although gill nets were introduc in some localities during that period. About 18 notable catches of mackerel by the use of purse sein are on record. At the present time, about 75% of t East Coast mackerel catches are taken by purse sein 7% in gill nets, and the remainder in traps and lin [*Com. Fisheries Review*, **13** (11) *72* (1951) Nove ber].



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PRESENT STATUS OF FLOUR AND BREAD ENRICHMENT REVIEWED

On the occasion of the decennial of the enrichment in the United States, the Committee on Cereals of the National Research Council recently reviewed the present status of the flour and bread enrichment in the U. S. This report is available upon request from The National Research Council, 2101 Constitution Avenue, Washington 25, D. C.

Twenty-six states have endorsed the program with compulsory legislation, and in other states a very large proportion of white bread and flour continues to be enriched on a voluntary basis. The Millers' National Federation and The American Bakers Association are continuing their wholehearted support of flour and bread enrichment. The report states that the long-sought standards and definitions of enriched bread now are just around the corner. The Committee's report advocates the general use of enriched bakery flour.

This report will be of interest to all concerned with the general nutritional problems and will be of special significance in view of the presently contemplated legislations on this topic.

EMPLOYMENT NOTICES

CHEMIST: 9 yrs. varied experience in food research and development; bench, kitchen, pilot plant, administrative. Excellent academic and industrial bio-chemical background. Now employed in supervisory capacity. Age 35, M.S., single. Desires position in development or technical service and liaison offering advancement opportunities. **REPLY BOX 200, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.**

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AVAILABLE: Food Technologist, grad. Univ. of Mass. Experience beverages, frozen and canned foods — product research and quality control. Veteran, married, age 30. Prefer East Coast. REPLY BOX 201, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

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Advertisers' Index

	PAGE
American Can Co.	13
Aseptic Thermo Indicator Co.	15-16
Brewers Yeast Council, Inc.	29
Distillation Products Industries	21
Dodge & Olcott, Inc.	25
Felton Chemical Co., Inc.	11
Food Development Laboratory	30
Food Machinery & Chemical Corp.	7
Food Research Laboratories, Inc.	30
Fritzsche Bros., Inc.	30
General Foods Corp. (Diamond Crystal Salt)	26
The Griffith Laboratories, Inc.	19
H. Kohnstamm & Co., Inc.	17
Howi Coders Corp.	30
LaWall & Harrisson	28
Magnus, Mabee & Reynard, Inc.	2
Minneapolis-Honeywell Regulator Co.	8-9
Norda Essential Oil & Chemical Co., Inc.	28
The Pfaudler Co.	2nd cover
Chas. Pfizer & Co., Inc.	3rd cover
Rohm & Haas Co.	4th cover
Schwarz Laboratories, Inc.	28
Stilton, Inc.	1
Foster D. Snell, Inc.	30
Wm. J. Stange Co.	5
Sterwin Chemicals, Inc.	14
U. S. Treasury	27
Von Ameringen-Haebler, Inc.	23

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During the Sixth International Conference of the Food and Agriculture Organization of the U. N. held in November, 1951 in Rome, Argentina, Japan, Laos and Nepal were admitted to membership of the FAO.

Argentina is the biggest food producer in South America. Laos is a French Indo China Kingdom and Nepal is a Himalayan State.

Their admission brought the membership of the FAO to 70, but not for long. Two present members, Hungary and China, have submitted resignations which become effective on December 31, 1951. Thus the present membership of the FAO is 68.

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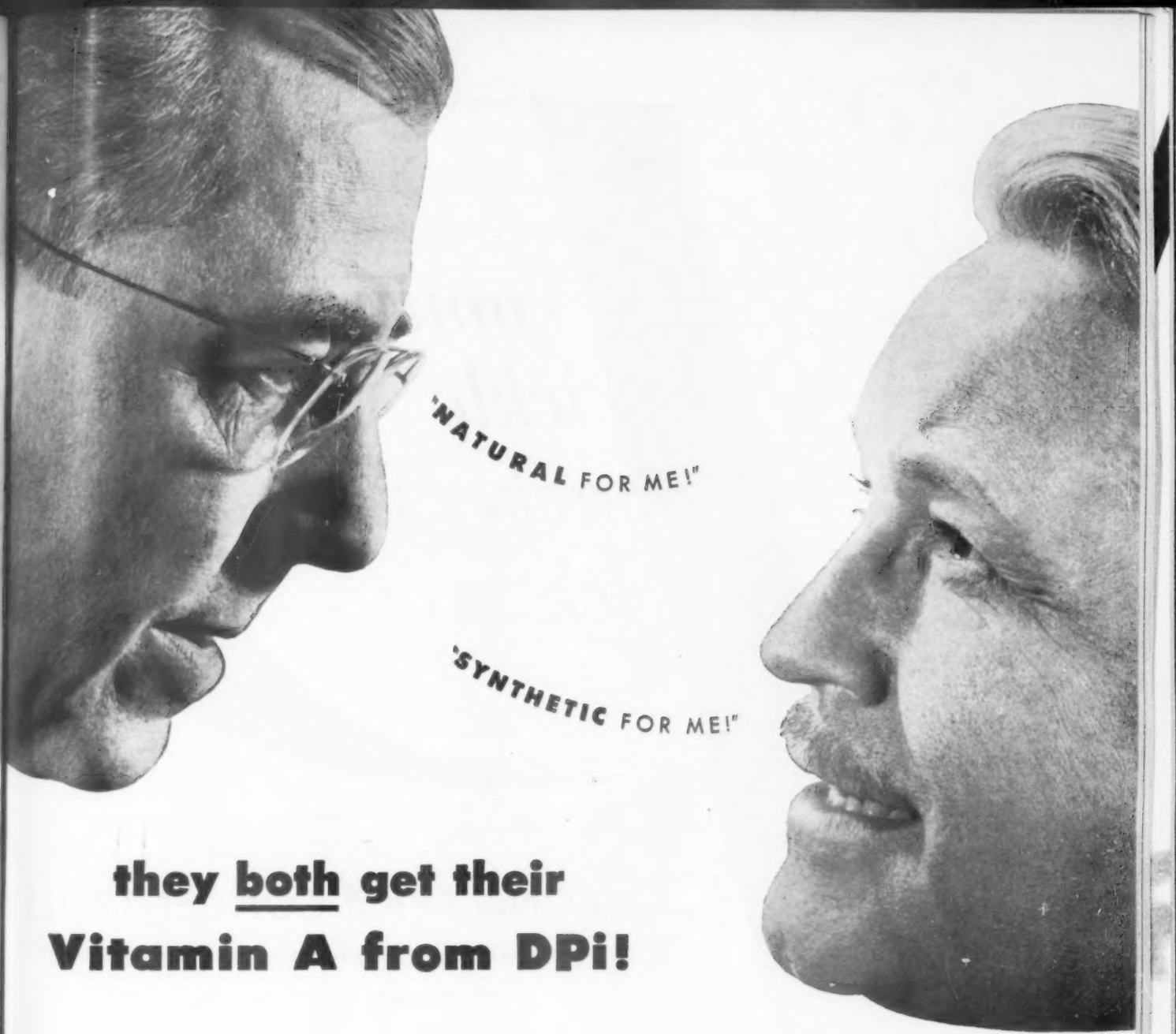

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CONTENTS

RAPID METHOD FOR MOISTURE IN FRUITS AND VEGETABLES BY OXIDATION WITH DICHROMATE. II. PINEAPPLE-RICE PUDDING, RICE, PRUNES, AND CORN. Yoshio Tomimatsu and Herbert F. Launer 281

FLAVOR COMPONENTS OF RASPBERRIES. P. Adams, E. Merwin, and M. Mogavero 285

ONION PUNGENCY AND ONION FLAVOR: THEIR CHEMICAL DETERMINATION. Edward F. Kohman 288

HEAT INACTIVATION OF PECTINESTERASE IN CITRUS JUICES. A. H. Rouse and C. D. Atkins 291

EFFECT OF PURE SALT ON THE OXIDATION OF BACON IN FREEZER STORAGE. A. M. Gaddis 294

THE RETENTION OF CAROTENE DURING THE CANNING OF TOMATO JUICE. N. H. Strodtz, T. E. Blumer, and L. E. Clifcorn 299

ANTIOXIDANTS AND FOOD PRESERVATION. R. W. Bentz, T. J. O'GRADY, AND S. B. WRIGHT 302

A PRELIMINARY STUDY OF FACTORS AFFECTING THE QUALITY OF PICKLES ON THE CANADIAN MARKET. A. H. Jones and G. S. Harper 304

USE OF ANTIOXIDANTS IN THE FROZEN STORAGE OF TURKEYS. A. A. Klose, E. P. Mecchi, and H. L. Hanson 308

THE EFFECT OF FLUCTUATING STORAGE TEMPERATURE ON THE QUALITY OF STORED FROZEN FOODS. J. D. Winter, Andrew Hustrulid, Isabel Noble, and Enid Sater Ross 311

A COMPARISON OF VARIOUS METHODS FOR THE DETERMINATION OF SPOILAGE IN FISH. Lionel Farber 319

WHAT A MANAGEMENT CONSULTANT CAN DO FOR A CLIENT Organization. Robert Wise 324

BOOK REVIEW 327

NEWS OF THE INSTITUTE *6*

SELECTED ABSTRACTS *24*

Authors of papers intended for publication in FOOD TECHNOLOGY should request from the editorial office a copy of the booklet, entitled "Information and suggestions to authors." Manuscripts submitted for publication in FOOD TECHNOLOGY should follow the style described in this booklet.

The Institute of Food Technologists assumes no responsibility for statements in contributed articles appearing in FOOD TECHNOLOGY. Editorials present only opinions of the writers and do not necessarily reflect policies of the Institute of Food Technologists.

(This advertisement originally appeared in full-color in TIME, BUSINESS WEEK and FORTUNE.)

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Welcome to the New Editor of Food Technology and Food Research

On June 8, 1952, the Council of the Institute of Food Technologists at its meeting at Grand Rapids, Michigan, appointed Dr. Martin S. Peterson Editor of FOOD TECHNOLOGY and FOOD RESEARCH. By action of the Council in the same session, the former Editor, Z. I. Kertesz, was appointed Consulting Editor of both journals.

Dr. Peterson, who is Chief, Scientific Publications and Reports Office, Quartermaster Food and Container Institute for the Armed Forces, Chicago, will assume these additional duties on August 1, 1952. The new Editor brings to his assignment a broad background of professional experience in the editorial field extending over the past twenty years. During this period he has served as Technical Editor at the Western Regional Research Laboratory of the USDA at Albany, California; Technical Editor of the Nebraska Agricultural Experiment Station at Lincoln, Nebraska; and as a Consultant for the Quartermaster Institute. Since 1947 Dr. Peterson has been chief of the Institute's Publication Branch and its successor, the Scientific Publications and Reports Office. His responsibilities include assistance in planning the Food and Container Institute's Research and Development Program on foods and containers, supervision of publications, editing technical reports and public relations work. To food technologists he is perhaps best known for his excellent quarterly Activities Report of the Research and Development Associates.

Dr. Peterson is a graduate of Reed College, Portland, Oregon, and obtained his Ph.D. from the University of Nebraska. Prior to his affiliation with the Government he taught English at the University of Chicago, Iowa State College and at the University of Nebraska. He is a native of Oregon, has written a number of articles on the West and is the author of "Joaquin Miller: Literary Frontiersman," published by the Stanford University Press, and co-author of "Using Better English," published by the Ronald Press.

The new Editor's extensive experiences in editing and his many years of contact with those engaged in research on foods and agricultural products and in food technology provide a sound background for his present assignment. He may be assured of the fullhearted cooperation of the officers and members of the IFT and of his Editorial Boards. We wish him many enjoyable and successful years as Editor of FOOD TECHNOLOGY and FOOD RESEARCH.

Z. I. K.

News of the Institute

1952 COUNCIL MEETING PROCEEDINGS

(The following Proceedings of the Meeting of the Council of the IFT, held at the Pantlind Hotel, Grand Rapids, Michigan, on June 8, 1952, have been condensed from the Minutes prepared by the Executive Secretary and are printed here for the information of the membership.)

All officers of the IFT, 33 Councilors, and 5 invited guests were present.

1. The meeting was called to order by President Charles N. Frey at 9:30 a. m.

2. The Council received the proceedings of the Executive Committee Meeting held on June 7 and took action on the recommendations contained therein as follows:

A. It was moved, seconded and carried that a committee be appointed at once to give further consideration to the report of the Exhibits Committe and a suggested plan for handling Annual Meetings submitted by Ray B. Wakefield, the report of this committee to be submitted to the Executive Committee of the Council at its Fall Meeting.

B. It was moved, seconded and carried that the Executive Secretary be appointed ex officio member of the General Arrangements Committee of the local section at all future Annual Meetings.

C. It was moved, seconded and carried that Z. I. Kertesz be appointed Consulting Editor of FOOD TECHNOLOGY and FOOD RESEARCH.

D. It was moved, seconded and carried that in accordance with the recommendations of the Publications Committee and the Executive Committee of the Council, the subscription rate of FOOD RESEARCH be increased by $1.00 per year for all classes of subscribers and that no consolidation of the journals be made.

E. John H. Nair, Chairman of the Publications Committee, submitted a supplementary report from his committee, as follows:

"As the result of a scheduled meeting of this Committee held on the evening of June 7th, attended by a majority of the members, certain actions and recommendations are herewith presented to the Council in addition to those previously reported.

The Oregon Section has voted unanimously in favor of consolidation of FOOD RESEARCH and FOOD TECHNOLOGY into a single publication, while the Pittsburgh Section has reported a vote of 20 to 5 against consolidation. These results confirm the earlier committee recommendation that no consolidation take place during the calendar year 1953, but that further study be made of the proposition by a successor committee for report a year hence.

It is with regret and deep appreciation of the effective, unselfish editorial direction given to our journals by Dr. Z. I. Kertesz during the past two years that this committee feels compelled to recommend acceptance of his resignation as Editor to take effect as rapidly as transfer of duties can be made to a successor.

The committee recommends the appointment of Dr. Martin S. Peterson of Chicago by the Council as Editor of FOOD TECHNOLOGY and FOOD RESEARCH for a period of one year at a stipend of $3,000.00. This is conditioned on the acceptance by the Council of the terms submitted by Dr.

(Continued on page 8)

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News of the Institute

(Continued from page 6)

Peterson and his agreement to the following: Office to be maintained at 11606 South Bell Avenue, Chicago, Illinois, with editorial address to be the same or alternatively, a postoffice box in the Morgan Park sub-station; salaries to be paid individually by National Headquarters to himself and each assistant; and that a fund be provided him to be renewed by payments against approved expense vouchers.

The following budget is recommended:

Editorial Stipend	$3,000.00
Secretarial Assistant	2,800.00
Office Maintenance	850.00
Travel	450.00
Contingent	400.00
Total	$7,500.00

Your committee has considered some twenty-five candidates proposed for the post of Editor, a number of them now being present in this Council Meeting. It would serve no useful purpose and might be embarrassing to many here to review in details the factors which led to the eventual choice of Dr. Peterson as the best qualified and available person to recommend for appointment.

It is recommended that the Council reaffirm its previous position that it is undesirable for Regional Sections to undertake or maintain local publications dependent on advertising revenues which might jeopardize potential advertising by the subject firms in our national journals."

F. It was moved, seconded and carried that Dr. Martin S. Peterson be appointed Editor of FOOD TECHNOLOGY and FOOD RESEARCH and that the budget for the Editorial Office be set as recommended under E above.

G. The following budget prepared and submitted by the Finance Committee and approved by the Executive Committee was adopted:

ESTIMATED INCOME

1. Membership Dues:		
3,207 @ $7.50	$24 052.50	
179 @ 2.50	447.50	
	24,500.00	
LESS 50% to be credited to F. T. Subs.	12,250.00	$12,250.00
2. Member and Non-Member Subs. F. T.		
563 Non-Members @ $7.50	$ 4,222.50	
3,386 Members @ $2.50 and $7.50	12 250.00	$16,472.50
3. Member and Non-Member Sub. F. R.		
658 Members @ $5.50	3,619.00	
1,300 Non-Members @ $6.40	8,450.00	12,069.00
4. Advertising FOOD TECHNOLOGY This is the amount actually booked for calendar year 1952		35,689.00
5. Advertising FOOD RESEARCH Amount actually booked for 1952		799.80
6. Income from Annual Meeting		5,000.00
7. Sales of back issues of Journals		400.00
8. Misc. receipts (Mailing Lists, etc.)		250.00
Total Estimated Income		$82,930.30

(Continued on page 10)

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Macon, Georgia

1314 Wood Street
Dallas 1, Texas

News of the Institute

(Continued from page 8)

ESTIMATED EXPENDITURES

9. Food Technology—Printing and Mailing (912 pgs. @ $32.60)	29,731.20	
10. Food Technology—Circulation Expense	671.50	
11. Food Research—Printing and Mailing	9,190.50	
12. Food Research— Circulation Expense	830.00	
13. Editorial Expense	7,500.00	
14. Food Technology—Advertising Commissions	9,822.25	
15. Food Research—Adv. handling costs (6.87/issue)	41.22	
16. Rent, Telephone and Telegraph	2,200.00	
17. Stationery, Printing and Postage	2,500.00	
18. Clerical Expense	6,000.00	
19. Payroll Taxas	300.00	
20. Secretary's Salary	7,200.00	
21. President's Office	750.00	
22. Office Furniture and Equipment	500.00	
23. Gen. Exp. National Hdqrs.	1,200.00	
24. Travel	1,000.00	
25. Contingencies (to be expended only by President)	1,000.00	
26. Audits, Surety Bonds and Insurance	500.00	
27. Monsanto Award	100.00	
28. Directory	750.00	
Total Estimated Expenditures		$81,786.67
Surplus		$ 1,143.63

H. The following reports from the Executive Secretary and the Treasurer were received.

I. MEMBERSHIP. (See section on Membership printed in the Secretary's Report in the proceedings of the 1952 Annual Business Meeting, page 14, this issue).

II. JOURNAL CIRCULATION. (This statement may be also found in the record of the 1952 Annual Business Meeting, page 14, this issue).

III. JOURNAL OPERATING STATEMENTS —May 1, 1951, to April 30, 1952.

FOOD TECHNOLOGY

OPERATING INCOME:

50% of Membership Dues	$12,205.53	
Non-Member Subscriptions	4,503.17	
Advertising Income (Net Billing)	34,584.85	
Sales of Back Issues	326.84	
Total Operating Income		$51,620.39

OPERATING EXPENSE:

Printing and Mailing	$27,547.41	
Circulation Expense (Billing, collecting, add. plates, etc.)	587.67	
Advertising Expense (Commissions, handling, sales promotion aids)	9,901.15	
Proportionate share of Admin. Overhead, National Hdqrs. (30% of Administrative Expense $16,610.54)	4,983.16	
Editorial Expense (⅔ of total $7,200)	4,800.00	
Discounts Allowed	667.72	
Total Operating Expense		$48,487.11
Net Surplus		$ 3,133.28

FOOD RESEARCH

OPERATING INCOME:

Member and Non-Member Subscriptions	$10,689.24	
Advertising Income (Net Billing)	832.50	
Sale of Back Issues	42.19	
Total Operating Income		$11,563.93

OPERATING EXPENSE:

Printing and Mailing	$ 8,433.58	
Circulation Expense	991.60	
Advertising Expense	42.74	
Proportionate share of Admin. Overhead, Nat'l. Hdqrs. (10% of total)	1,661.05	
Editorial Expense (⅓ of total)	2,400.00	
Total Operating Expense		$13,528.97
Net Deficit		$ 1,965.04

Since the matter of consolidating the two journals into one publication has come up for discussion, the Garrard Press was requested to make a cost analysis to determine what, if any, savings would result from such a consolidation. This analysis was based on the assumption that material now appearing in Food Research would be published in the consolidated journal, and concludes with the following statements:

There are approximately 1,000 subscribers to Food Research who do not receive Food Technology. If these subscribers were to receive the consolidated Journal, about 1,000 additional copies of Food Technology would have to be printed at a cost for a 92-page issue of $278.00.

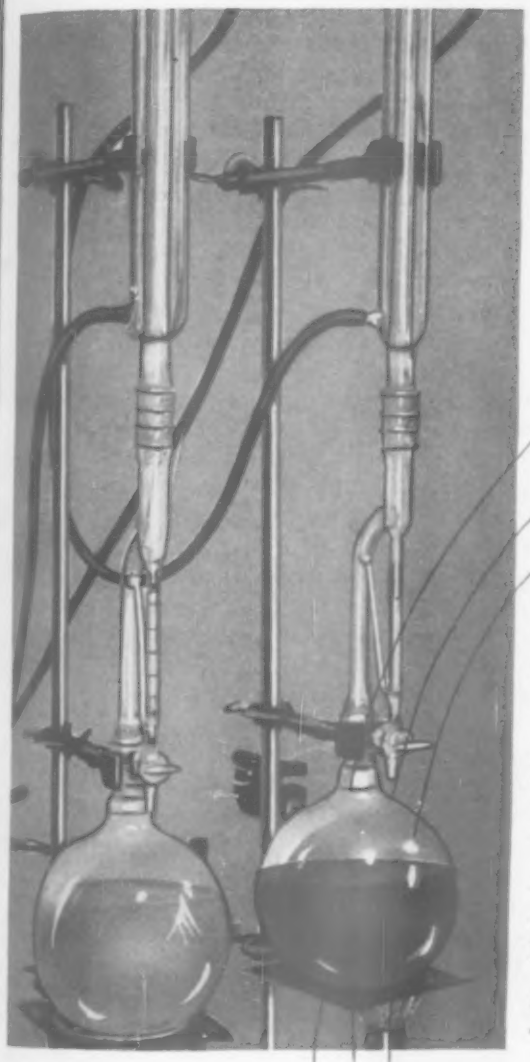
The printing of the material published in Food Research as a part of Food Technology does effect certain production savings such as the cost of the cover, mailing operations, some binding and pressroom operations and about 50% of the mailing postage. The cost of typesetting and engravings remain, for all practical purposes, about the same.

However, these production savings are more than offset by the cost of the larger circulation you would be giving to the Food Research material if it were included in Food Technology. You would be printing about two thousand more copies of the Food Research articles, than under the present basis of two separate publications and about 1,000 more copies of the Food Technology section. The press run on Food Technology is currently about 2,000 more copies than on Food Research. Also, the subscription lists of the two journals are not parallel. The production cost of sending the material published in the two journals to all the readers of both journals will exceed the production savings realized by a consolidation.

The majority of the members of the Institute do not appear to be interested in the reports of original and basic research as published in Food Research. To include these papers in the major publication which goes to all members would be more expensive than publishing Food Research with a limited circulation for those institutions and individuals interested in basic research. Although the circulation of Food Research is limited it apparently fulfills a definite need, as evidenced by the 17-year unbroken subscrip-

(Continued on page 12)

The Taste of Sunshine—All the Time



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News of the Institute

(Continued from page 10)

tion record of major libraries throughout the world. It also appears to meet a need of a substantial minority of your membership.

IV. Herewith is the Treasurer's Report for the Fiscal Year ended April 30th, 1952. It will be noted that our cash position has improved during the year.

TREASURER'S REPORT

CASH BALANCE, May 1st, 1951		$36,946.03
RECEIPTS:		
Dues	$25,482.82	
FOOD TECHNOLOGY: Advertising, Non-Member Subs. and Manuscript Subsidies	39,335.70	
FOOD RESEARCH: Advertising, Subscriptions and Manuscript Subsidies	11,340.40	
Office Space Sub-Let	361.71	
Refund on Stationery Purchase	1.50	
Refund on Travel Advances	217.96	
Mailing Lists Sold	799.03	
Proceeds from Annual Meeting	6,000.00	
Cash Sales of Back Issues of Journals	49.35	
Sale of IFT Seals	17.25	
Repayment of Loan to Section	1,000.00	
Funds Received for Monsanto Award	100.00	
Refund on Surety Bond Premium	12.50	
TOTAL RECEIPTS		$84,718.22
TOTAL BANK DEPOSITS		$84,718.22
DISBURSEMENTS:		
Dues Refunded—overpayments and rejections	$ 164.25	
FOOD TECHNOLOGY—Printing and Mailing	28,583.29	
FOOD TECHNOLOGY—Advertising Expense	9,598.67	
FOOD TECHNOLOGY—Circulation Expense	536.47	
FOOD RESEARCH—Printing and Mailing	8,904.67	
FOOD RESEARCH—Advertising Expense	42.74	
FOOD RESEARCH—Circulation Expense	935.70	
Sales Expense — Back Issues of Journals	98.39	
Rent, Telephone and Telegraph	2,036.07	
Clerical Expense	3,298.60	
Secretary's Salary	5,942.40	
Taxes Withheld from Salaries	2,056.00	
Stationery, Printing and Postage	1,793.45	
Travel	904.17	
Editor's Office	6,434.40	
Annual Meeting Expense	176.49	
President's Office	819.59	
Office Furniture and Equipment	325.65	
Audits and Surety Bonds	294.69	
Sales Expense of Mailing Lists	72.78	
Contingencies (to be expended only by the President)	266.12	
Gen. Expense—Nat'l. Hdqrs.	1,173.33	
Payroll Taxes	291.67	
Loans to Sections	1,000.00	
TOTAL DISBURSEMENTS		$75,749.59
CASH BALANCE, April 30, 1952		$45,914.66

P. K. BATES, Treasurer

I. It was moved, seconded and carried that the foregoing report be approved and accepted.

J. It was moved, seconded and carried that the complete report of the auditors be reproduced and distributed to all Councilors.

K. It was moved, seconded and carried that Marian A. Gilchrist be appointed Assistant to the Executive Secretary and as such be authorized to sign checks drawn on the Operating Fund of the Institute.

L. It was moved, seconded and carried that Charles S. Lawrence be reelected Executive Secretary, Philip K. Bates reelected Treasurer and Arthur N. Prater elected Assistant Treasurer for a period of one year.

M. It was moved, seconded and carried that J. R. Matchett, S. C. Prescott and L. E. Clifcorn be appointed members of the Babcock Award Committee for a period of three (3) years.

N. It was moved, seconded and carried that a functional committee on Publicity and Public Relations be appointed and that this Committee be authorized to utilize the services of public relations counsels whenever such services may be obtained without cost to the Institute. This Committee is to be charged with the activation of the recommendations of the ad hoc committee on the problem of publicity and public relations.

O. It was moved, seconded and carried that the report of the Editor be accepted and approved, including the appointment of R. R. Legault as an Associate Editor of FOOD RESEARCH.

P. It was moved, seconded and carried that the Executive Secretary make the necessary arrangments for the publication of an Institute Directory (the sum of $750.00 to cover compilation cost is included in the Budget).

Q. It was moved, seconded and carried that no further interpretation of Section 9, Article VI of the Constitution is necessary to authorize the Executive Secretary to suspend members who have failed to pay their dues prior to the mailing of each March issue of FOOD TECHNOLOGY.

R. It was moved, seconded and carried that the suggestion received from the Ohio Valley Section relative to the allocation of a portion of national membership dues to Regional Sections be referred to the Finance Committee for study and report to a subsequent meeting of the Council.

S. It was moved, seconded and carried that the request of B. W. Clarke for the appointment of a Committee on Objective Tests for Quality Control Factors be approved if a suitable group wishes to undertake such a project.

(Continued on page 14)

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News of the Institute

(Continued from page 12)

T. It was moved, seconded and carried that the request of I. J. Hutchings for the appointment of a Committee to study the problem of standardizing the methods used in thermal resistance studies be approved.

U. It was moved, seconded and carried that the request of F. C. Blanck for the appointment of a Committee on Definitions and Standards be referred to an ad hoc committee to be appointed to study the desirability of establishing such a committee and to formulate definite and detailed objectives, and mode of operation, if such a Committee is recommended.

V. It was moved, seconded and carried that the Executive Committee be authorized to approve the chartering as a Regional Section any Canadian group of not less than fifteen (15) IFT members who meet the other requirements and who wish to become a Regional Section of the Institute.

W. It was moved, seconded and carried that A. N. Prater represent the Committee on Resolutions in the preparation of suitable resolutions of thanks to the individuals and organizations contributing to the success of the 1952 Annual Meeting and that the Executive Secretary prepare for the signature of the President, personal letters of appreciation to be sent to certain organizations and individuals.

X. It was moved, seconded and carried that the Executive Secretary be authorized to advance to any Regionel Section that is to be host to an Annual Meeting a sum not to exceed $1,000.00.

Y. It was moved, seconded and carried that Section 6, Article V of the By-Laws be changed to read as follows:

"Original applications and applications for renewal of student membership shall be accompanied by a statement that the applicant is a regularly enrolled student in one or more of the sciences or branches of engineering associated with Food Technology. This statement must be signed by the head of the department in which the student carries his work or by a faculty member who is also a member of the Institute."

Z. It was moved, seconded and carried that the reports of all committees not heretofore mentioned be received.

3. NEW BUSINESS

1. It was moved, seconded and carried that the designation of the Committee on Education and Curriculum be changed to the Committee on Education for Food Technologists.

2. It was moved, seconded and carried that the Committee on Constitution review the entire subject of the election of Councilors and Alternate Councilors of Regional Sections and of Councilors-at-Large, their accrediting, their admission to Council Meetings, any provisions aiming to insure the representation of each Regional Section at Council Meetings and the exact delineation of who shall be entitled or permitted to attend Council Meetings, and a report on this be made at the next Annual Meeting of the Council.

3. It was moved, seconded and carried that a standing Committee on Resolutions be appointed.

4. There being no further business, the Council adjourned at 3.00 P. M.

1952 ANNUAL BUSINESS MEETING OF THE IFT

The following are the proceedings of the Annual Business Meeting held at the Pantlind Hotel, June 11, 1952. President Charles N. Frey, presiding, called the meeting to order at 1:15 P. M.

1. President Frey introduced those at the speakers' table.

2. The Secretary announced the results of the election of National Officers as certified by the Tellers Committee:

President-Elect: Berton S. Clark.
Councilors-at-Large: H. C. Diehl, George Garnatz, Louis B. Howard, Walter A. Maclinn, and Harold S. Mitchell.

3. A. N. Prater, Chairman of the Resolutions Committee, offered the following resolution:

"By unanimous action of the Council of the Institute of Food Technologists, the Resolutions Committee was directed to present the following resolution to the membership. As Chairman of this Committee, it is my pleasure to present this resolution at this time:

WHEREAS, it is recognized that many individuals and organizations have contributed to the success of the 12th Annual Meeting through unstinted personal effort and corporate support through donations of time and money, and

WHEREAS, the membership of the Institute is desirous of recognizing the valuable contributions of these persons and organizations;

NOW THEREFORE, BE IT RESOLVED, That the Institute of Food Technologists express its sincere appreciation and gratitude for the meritorious services rendered by the following organizations and individuals:

Joseph Adams Co.: Joseph Adams; Baker Laboratories: W. L. Thompson; Basic Food Materials, Inc.: J. C. Sanford; Belshaw Manufacturing Co.: C. F. Belshaw; W. Clark Ltd.: T. B. Calder; Cowles Chemical Co.: C. M. Moore; Difco Laboratories, Inc.: C. W. Christensen, H. W. Schoenlein; Dow Chemical Co.: E. Briggs, Parker Frisselle, Paul Wolf; Envoldsen Shrimp, Inc.: Karl Envoldsen, Florence Ricketts; General Electric Co.: I. Matelsky; General Foods Corp.: M. W. Alderman, W. J. Mahan, M. O. Ricker; Gerber Products Co.: R. B. Wakefield, M. R. Dietz, L. W. Beem, Wm. Fisk, P. G. McGowan, Ray Frodey, Edna Mae McIntosh, Sylvia Ritter, H. L. Delo, Howard Hays, Eloise Finkbinder; H. J. Heinz Co.: Robert Marshall; Huron Milling Co.: L. J. Minor; J. H. Kellogg Co.: Mary Barber, Regina Frisbie; Merck & Co., Inc.: George Alexander; Michigan Fruit Canners: F. J. Erickson; Michigan State College: F. W. Fabian, Pauline Paul, Lois Guiher, R. E. Marshall, W. F. Robertson, C. L. Bedford, Mary Morr; Owens-Illinois Glass Co.: H. C. Scott, H. F. Hackenberg, R. B. Stover, J. M. Wheaton, H. A. Barnby, Hugh Griswold; Reynolds Metals Co.: William Purring; Shedd-Bartush Foods: F. C. Witek; H. O. Way Co.: F. F. Fischer, F. J. Zidar, H. O. Way; Westinghouse Electric Co.: Camille Beauchamp; and Wyandotte Chemicals Co.: Armin Roth, A. L. Sotier.

The Council further directed that appropriate letters be sent by the President of the Institute to these people and their organizations. I am happy to report to the membership that this is being done."

(Continued on page 16)

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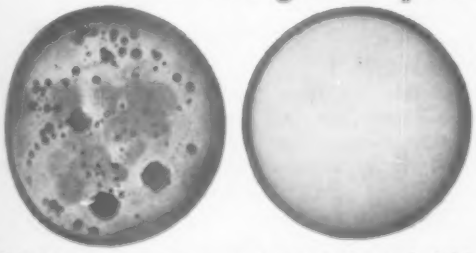
SANITIZING AGENT

to do a more effective sanitizing job throughout your plant!



Petri dish showing colonies of bacteria before the use of ROCCAL.

Petri dish showing no bacterial growth after the use of ROCCAL.

In the Food Industry, the importance of using only the best in sanitizing methods cannot be over-emphasized.

In Roccal, the *original* quaternary ammonium germicide, the food industry is offered a sanitizing agent that is laboratory controlled and tested. The uniform quality of Roccal means uniformly good results in doing a proper sanitizing job.

Roccal is a powerful germicide. In recommended dilutions, it is non-poisonous, non-irritating to the skin, virtually odorless and tasteless.

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News of the Institute

(Continued from page 14)

I move that the membership affirm the action of the Council.

This resolution was adopted by unanimous vote.

4. P. K. Bates, Treasurer, presented a brief resumé of the Treasurer's Annual Report as follows:

Cash on Hand at beginning of Fiscal Year		$36,946.03
Total Receipts		84,718.22
Total Disbursements		75,749.59
Cash on Hand at end of Fiscal Year		45,914.66
Receipts—Dues	$25,482.82	
Food Technology	39,335.70	
Food Research	11,340.40	
Annual Meeting	6,000.00	

Dr. Bates stated that a complete and detailed report had been submitted to all Councilors and report furnished the Editor of Food Technology for publication of such parts as he deems appropriate.

5. The Secretary presented a brief resumé of his Annual Report as follows:

MEMBERSHIP:

Total Membership, May 1, 1951		3,208
Reinstatements and New Members elected		488
Total		3,696
Losses: Deaths and resignations	53	
Dropped for non-payment	257	310
Balance—April 30, 1952		3,386
Net gain for Fiscal Year 1952		178
Net gain for Fiscal Year 1951		298

MEMBERSHIP CLASSIFICATION:

	1951	1952	Plus or Minus	
Professional Members	2,256	2,352	plus	96
Members	752	855	plus	103
Student Members	200	179	minus	21

JOURNAL CIRCULATION:

Total Circulation as of April 30, 1952:

Food Technology:		
Member subscriptions	3,386	
Non-Member subscriptions	563	
Exchange, Editorial and Complimentary	62	
Total		4,011
Net Gain for the Year		323
Food Research:		
Member subscriptions	658	
Non-Member subscriptions	1,300	
Exchange, Editorial and Complimentary	25	
Total		1,983
Net Gain for the Year		143

An analysis of the cost of the two journals either separately or as a combined publication indicated that it was definitely more economical to continue the two journals. A copy of the complete and detailed report has been distributed to all Councilors and will be furnished to the Editor of Food Technology for the publication of such parts as he deems appropriate.

6. At this point, Dr. Frey turned the gavel over to Dr. Bernard E. Proctor with appropriate remarks.

7. Dr. Proctor, President of the IFT for 1952-53, expressed his appreciation for the confidence shown in him by the members of the Institute.

8. There being no further business, the meeting was adjourned at 2:00 P. M.

Charles S. Lawrence,
Executive Secretary

AUDITOR'S REPORT

(The following are excerpts from the report submitted on May 23, 1952 by George V. Rountree and Co., Certified Public Accountants of Chicago, Ill.)

Institute of Food Technologists, Inc.
176 West Adams Street
Chicago, Illinois.

In accordance with instructions received, we have examined the accounts and records of Institute of Food Technologists, Inc. for the year ended April 30, 1952. Statements indexed on the preceding page together with following comments set forth the results of our examination. Our examination was made in accordance with generally accepted auditing standards and accordingly included such tests of accounting records and such other auditing procedures as we considered necessary in the circumstances.

Subscriptions to the two trade magazines published by the Institute are on a calendar year basis. As the Institute is required to furnish the issues for the balance of the year, two-thirds of the subscriptions from non-members for the year ending December 31, 1952 amounting to $7,248.32 is deferred. In the previous year no such provision was made.

In our opinion, subject to the above, the accompanying Balance Sheet and related Income and Expense Statement present fairly the financial position of Institute of Food Technologists, Inc. at April 30, 1952 and the results of its operations for the year then ended, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

George V. Rountree & Co.

Comments on Balance Sheet:

Cash in bank:
General fund $42,103.49
Operating fund $3,811.17

Bank balances are in agreement with a certificate furnished us by The First National Bank of Chicago after taking into consideration checks not presented for payment April 30, 1952.

Accounts receivable:
Food Technology $595.85
Food Research $855.54

Accounts receivable are from Garrard Press, Champaign, Illinois, which publishes the two journals. The receivables represent principally charges for advertising which the publisher collects and remits to the Institute. The balances were confirmed.

Investment:
U. S. Savings bond, Series F $835.00

The Institute owns one $1,000.00 face value U. S. Savings Bond, Series F, which was issued in August, 1945 and is due August, 1957. The redemption value at April 30, 1952 was computed at $835.00. The bond was presented for our inspection.

Inventories:
Back issues of Journals $1.00
Emblem seals $64.30

It is the policy of the Institute to have extra issues of the journals printed which are held for possible sales at a later date. These are carried at the nominal value of $1.00. Emblem seals which are sold to members are carried on the books at $64.30.

Furniture and fixtures $643.91
Additions to fixed assets amounted to $421.74.

(Continued on page 22 following technical papers)

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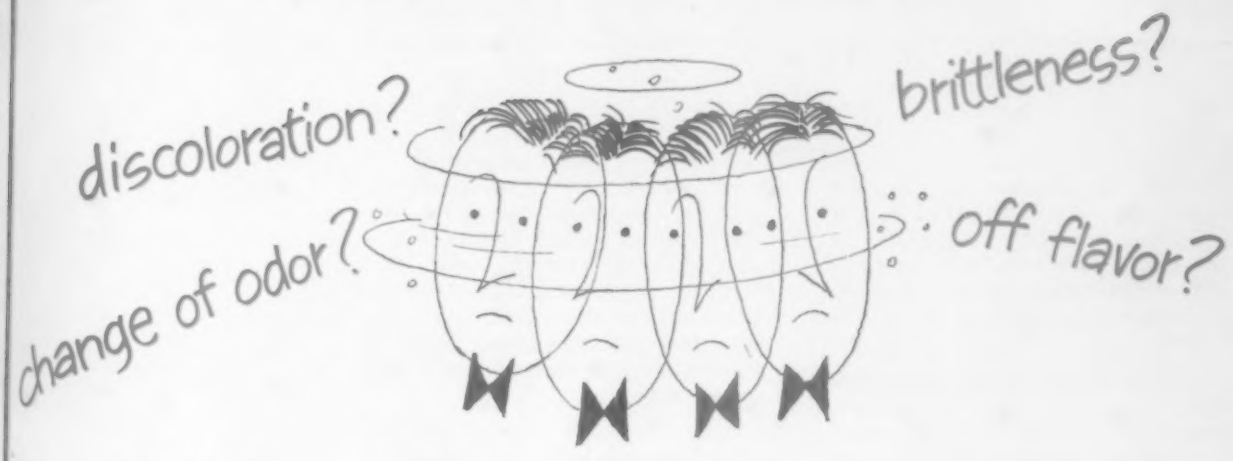

Baked Foods
Beef Tallow
Butter
Butter Fat Concentrate
Candy
Cereals
Chewing Gum
Chicken Fat
Citrus Oils
Cookies
Cream
Dairy Products
Dog Food
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Fish
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Packaging Materials
Pastry
Premixes
Spices
Vitamin A
Vegetable Oils
Wax

Many food and associated products are subject to deterioration by the action of the oxygen in the air. Such deterioration is frequently revealed in the form of a discoloration, brittleness or a change in odor or flavor. If problems such as these arise in connection with any of your products, either during or after manufacture, and the cause is oxidation, Tenox, an Eastman food-grade antioxidant, may well be the answer.

The addition of small quantities of Tenox materially retards the reaction which takes place between any susceptible or unstable ingredients and oxygen. Because Tenox is stable at high temperatures, it can be added at the most convenient point in your processing procedure. Since the oxidation reaction is accelerated by a rise in temperature, this point is usually prior to the application of heat.

The effectiveness of Tenox in retarding oxidative deterioration has been proven in those products listed in the column on the left. What about yours?

We will be pleased to send you additional information and sample quantities of Tenox for your evaluation. Our laboratories are staffed and equipped to test the effectiveness of Tenox in various food and associated products. We welcome your problems. Write to Tennessee Eastman Company, division of Eastman Kodak Company, Kingsport, Tennessee.

Tenox Eastman Food-grade Antioxidants

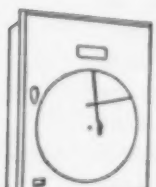
SALES REPRESENTATIVES: Tennessee Eastman Company—New York—260 Madison Ave.; Framingham, Mass.—7 Hollis St.; Cleveland—Terminal Tower Bldg.; Chicago—360 N. Michigan Ave.; St. Louis—Continental Bldg.; Houston—412 Main St. **Wilson Meyer Co.** (west of Rocky Mts.)—San Francisco, Los Angeles, Portland, Seattle. **Wm. J. Strange Co.** (east of Rocky Mts.)—Dallas, Milwaukee, St. Louis, Chicago, Indianapolis, Montgomery, Ala., Reading, Pa., Cleveland, Boston, Brooklyn, N. Y., Baltimore. **P. N. Soden Company, Ltd.** (Canada)—2143 St. Patrick St., Montreal, Quebec.

MEASURING FLOW FOR ALL INDUSTRY

THROUGH the arteries of industrial processes flow countless fluids. Whether they are used by the barrel or by the drop—their rate of flow is closely related to operating efficiency. For this reason, accurate measurement and control of flow have assumed high responsibilities in process supervision in practically every industry.

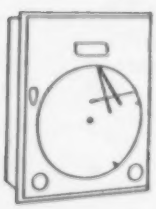
Because so many varied flow metering applications exist, Honeywell has developed several different families of instruments . . . each suited to a specific purpose. To work with these instruments, Honeywell engineers have designed meter bodies capable of metering the full gamut of industrial fluids, from viscous and corrosive to hot and high-pressure.

for flow accounting



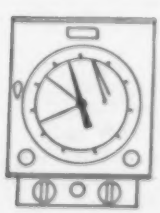
Cost accounting based on consumption of steam, water and other fluids is facilitated by the Brown Evenly Graduated Flow Meter. Its linear scale is easy to read at all flow rates. Its electronic integrator sums up total flow rapidly, accurately . . . is constructionally simple and easily maintained. This instrument is available as a mechanical meter with integral meter body, or as an electric receiver with remote transmission from a distant electric meter body.

for automatic control



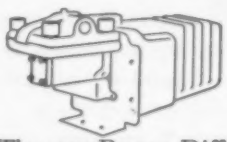
Where automatic flow control is the prime consideration, the Brown Square Root Flow Meter affords extra sensitivity by virtue of its expanded scale. It can be supplied with a wide selection of electric and mechanical meter bodies: low pressure, intermediate pressure and all-purpose; sealed armature type for corrosive materials. Interchangeable range tubes facilitate field change of calibration.

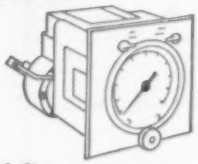
for flow proportioning



Many processes require that flows of two fluids be proportioned to each other—as, for example, fuel and air. For applications of this type, the *ElectroniK* Flow Meter combines many functions in one instrument case. It controls flow in the line which it is metering, resets its control index from a pneumatic signal transmitted to it from another instrument, and in turn retransmits the signal to a third indicator or controller. Cascade control of this sort holds temperature, air flow and fuel flow continuously in balance. The *ElectroniK* flow meter can be equipped with electronic integration . . . utilizes electric transmission from a remote meter body.

for graphic panels

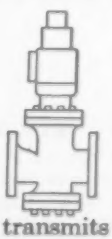




The new Brown Differential Converter operates on the pneumatic balance principle. Of sturdy construction, it uses no mercury, seals or strainers, is especially useful for metering corrosive fluids. It converts the measured pressure differential into a proportionate air output pressure, which actuates a remote flow-measuring instrument. Quick-responding and accurate, the converter is the ideal companion for miniature *Tel-O-Set* indicators, recorders and controllers. *Tel-O-Set* instruments are especially designed for top performance in graphic panel service . . . require only small panel space.

Modern processes demand

for viscous fluids



Flow of heavy oils, hot tar and other viscous liquids is readily measured by means of the Brown area type meter body. This unique device doesn't clog even with materials which would be difficult to measure by other methods. It transmits electrically to the remote meter, and produces a linear output which permits use of an evenly divided instrument scale.

Distillation of fatty acids is regulated from this central panel in the General Mills plant at Kankakee, Illinois, where critical process variables are measured and controlled within close limits by Brown instruments.

in the Food Industry

accurate flow control

In food processing plants, Brown flow meters aid cost accounting by telling exactly how much steam, water or other fluids flow to each production department . . . to each process. They supply data vitally needed for determining operating costs . . . for spotting sources of waste . . . for comparing efficiencies. In the boiler room, Brown flow meters give operators a ready check on individual boiler loading which permits most economical scheduling of load assignments.

In food processing operations which require automatic flow control, Brown instruments supply steam at precisely regulated rates. They often work as part of an interlocked system, which proportions related flows in predetermined ratios.

An additional value that goes with each Brown flow meter is the assurance of prompt, readily available service that helps to keep instruments in top condition. From more than 90 sales and service centers, you can obtain skilled assistance in installation, maintenance and replacement—often within a matter of hours.

Your nearest Honeywell representative will be glad to discuss your plant's flow metering problems, and to recommend the kind of instrumentation that best suits your needs. Call him today . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4569 Wayne Ave., Philadelphia 44, Pa.

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Honeywell
BROWN INSTRUMENTS

First in Controls

● *Important Reference Data*

Write today for Composite Catalog No. 5000 . . . and for Data Sheets on Specific food processing operations.

News of the Institute

(Continued from page 16 preceding technical papers)

OPERATIONS

We have prepared an Income and Expense Statement for the year ended April 30, 1952, page 2, showing the income from dues, subscriptions, advertising, and other sources totaling $76,117.62. Deducting the classified expenses aggregating $73,469.37 leaves net income for the year of $2,648.25 which is carried to membership equity on the Balance Sheet.

Regional Section News

GREAT LAKES SECTION

Following is the Section's slate of officers elected for 1952-53:

Chairman: L. J. Minor, Harbor Beach, Mich.
Vice-Chairman: Pauline Paul, East Lansing, Mich.
Secretary: W. L. Thompson, 4614 Prospect St., Cleveland, Ohio.
Treasurer: H. C. Scott, Toledo, Ohio.
Executive Committee: H. O. Way, Cleveland, Ohio; Isaac Matelsky, Cleveland, Ohio; G. L. Alexander, Detroit, Mich., and Max Dietz, Fremont, Mich.
Councilor: J. C. Sanford, Vermillion, Ohio.

MARYLAND SECTION

For its June meeting the Section was the guest of the Crown Cork and Seal Co., Baltimore, Md. The program for this June 20th event began in the afternoon with a tour of the Company's closure and machine divisions. One hundred and sixteen members took in the plant tour which lasted about three hours. Later, refreshments were served including a crab cake dinner, courtesy of the hosts. At the panel discussion following the dinner, the Section was addressed by the following Crown personnel: Dr. Ira S. Wilbur, Organic Coatings Section, Research Laboratory; Dr. S. S. Jenkins, Adhesives Section, Research Laboratory; and Dr. A. H. Warth, Research Consultant, Closure Division. Dr. Wilbur spoke on "Relation of lithographic protective coatings to food technology"; Dr. Jenkins on "Adhesives suitable for use in food closures"; and Dr. Warth on "Paper liners and rubber rings for food closures."

Door prizes were awarded through the courtesy of Crown Cork and Seal Co., Crosse and Blackwell Co., Federal Yeast Corp., Helwig and Leitch Co., and the Southern Packing Co., all of Baltimore.

PUGET SOUND SECTION

The Section's May meeting took the form of a dinner event held in the Fireside Room of the Sorrento Hotel in Seattle, Wash. Mr. P. J. Voss of the California and Hawaiian Sugar Refining Corporation was the speaker. His topic "Sugar Technology," augmented by a descriptive film, gave the members a complete picture of the production of cane sugar in Hawaii, including the steps necessary to produce the finished product at the plant site in San Francisco.

A short business meeting followed and the names of the nominees for office for the following year were presented. A discussion on the proposed merger of Food Technology and Food Research also took place and the members voted in favor of the consolidation.

The Section had a successful season. The next scheduled meeting will not be held until Fall.

DIXIE SECTION

The Dixie Section of The Institute of Food Technologists met on Friday, May 9, 1952 in Atlanta, Georgia. There was an afternoon tour of the Atlanta Water Works, followed by a chicken dinner at the Georgia Tech. dining hall. Dr. R. S. Ingols of Georgia Tech. talked on water problems.

The annual election of officers resulted in the election of the following slate:

Chairman: T. W. Kethley and J. Orvin Mundt.
Vice-Chairman: James Roger Hall and Stanley A. McHugh.
Secretary-Treasurer: Carroll Neff.
Editor: J. G. Woodroof.
Councilor: John J. Powers.

FLORIDA SECTION

The Florida Section of the IFT met in Orlando on June 19, 1952 at the Atlantic Brewing Company Tap Room. Mr. Beaty, brewmaster, explained the brewing process and some of the fine points of the art to the Section's members and guests.

A short business meeting was held and the results of the annual election of officers were announced:

Chairman: Gray Singleton, Lakeland, Florida.
Vice-Chairman: R. W. Kilburn, Lake Wales, Florida.
Secretary-Treasurer: Roger Patrick, Winter Haven, Florida.
Section Councilor: Fred W. Wenzel, Jr., Lake Alfred, Florida.
Executive Council: C. H. Brokaw, A. R. Pobjecky, M. K. Veldhuis, and D. W. Riester.

NORTHERN CALIFORNIA SECTION

Members of the Northern California Section met twice during the month of June.

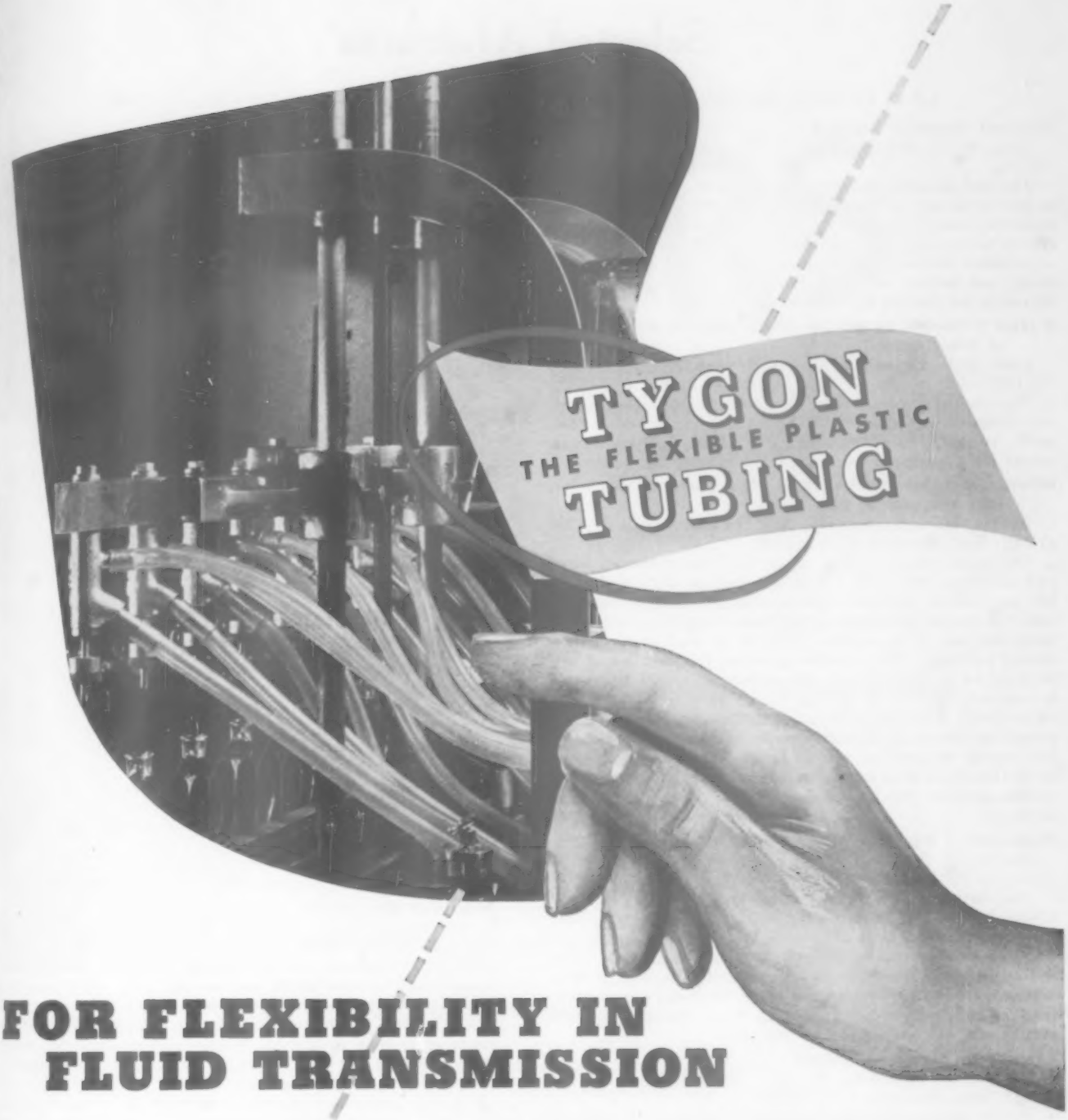
The first event was the regular meeting, at the Merchandise Mart, San Francisco, on June 19. The speaker was Dr. Maurice C. Fishler, head of the Division of Biology and Medicine of the U. S. Navy Radiological Defense Laboratories, San Francisco, and deputy member of the research and development board of the U. S. Dept. of Defense. His subject was "Newly Discovered Methods for Prevention and Treatment of Radiation Sickness."

The second event on the June program was the annual picnic of the Section, held at Alum Rock Park, near San Jose, on June 21. Members gathered at the affair at noon for an afternoon of games and fun, followed by dinner.

PERSONNEL

Harry E. Goresline, Food Technologist of the Poultry Branch of the Production and Marketing Administration, USDA, joined the staff of the Quartermaster Food and Container Institute of the Armed Forces in Chicago, Illinois. Dr. Goresline is Chief of the Stability Division of the Institute and will supervise scientific investigations on foodstuffs.

David R. Schwarz, Manager of the Manufacturing Division of Schwarz Laboratories Inc., of New York, N. Y., was elected vice president. Mr. Schwarz is a graduate of Harvard and Columbia Universities and is of the fourth generation of his family in the company.



FOR FLEXIBILITY IN FLUID TRANSMISSION

It's worth checking into — one of the many Tygon Plastic formulations may be the answer to your tough corrosion problems.

SHEET TYGON
heavy-duty tank linings; die-cut gaskets.

LIQUID TYGON
quickly applied coating, as protection against corrosive fumes.

MOLDED TYGON
Gaskets, grommets, diaphragms, molded mechanical items.

Where flexibility, clearness, and freedom from toxicity is a must in fluid transmission — there's only one answer, TYGON plastic TUBING.

Tygon Tubing is tough as leather, flexible as a piece of string, clear as glass. It neither imparts nor absorbs taste or odor. Resistant to acids, alkalies, oils, water, alcohols. Mirror-smooth surface inside and out speeds flow; makes cleaning easy. Tygon Tubing can be steam sterilized.

Tygon Tubing is made in bores in standard or special sizes up to 2" ID, and is available with an outer braid-reinforcement for pressure applications.

Bulletin T-77 contains complete technical information. Free on request. Write for it today. Address The U. S. Stoneware Co., Tallmadge Square, Akron 9, Ohio.

MANUFACTURERS AND FABRICATORS OF CORROSION RESISTANT MATERIALS AND EQUIPMENT SINCE 1865

Selected Abstracts[a]

ANALYTICAL METHODS

Industrial Analytical Research.

HALL, R. T., AND KIRKLIN, W. A. *Anal. Chem., 24,* 149 (1952).

The basic elements necessary for analytical research to fulfill its role in industry is discussed. The operation of an industrial analytical research group at the Experiment Station of Hercules Powder Co. is cited as an example. Also discussed are the types of problems handled, specific talents needed in a well-balanced group, and outlets into other fields. A few suggestions are offered on the training of personnel for this type of work.

A rapid titrimetric method for determining the water content of animal tissues.

COOK, S. F., CRAMER, C. F., AND KENYON, K. *Science, 115,* 353 (1952).

The method is described in the examn. of both whole blood and tissues of normal adult lab. rats. This procedure has been widely utilized in industrial labs. for the detn. of the water content of many substances such as paper, reagents, and foodstuffs.

Differentiation between fermented fruit juices (cider, berry, etc.) and genuine wine.

SULSER, H., AND HOGL, O. *Mitt. Lebensm. Hyg., 42,* 395 (1951); *Brit. Abstracts, C,* 116 (1952).

On paper chromatograms with aq. butanol-ethanol-water (4.0:1.1:1.9) as ascending solvent, and with aq. 0.1*N*. $AgNO_3$ + 5*N*. aq. NH_3 as developer, tartaric acid is detected in genuine wine, but not in cider or berry, whilst sorbitol is detected in the latter, but not in the former. Glycerol is detected in all fermented beverages. The sorbitol spots are rendered denser and more diffuse by unfermented glucose and fructose; the fructose is separately detected by the use of naphthorescorin (0.1%) in trichloracetic acid. Expts. to improve the sepn. of glucose and sorbitol by the use of different solvents are described. The samples require no previous prepn. From 10 to 20% of cider or berry (less in samples concd. by evapn.) is easily detected. For routine analyses the method is preferable to ordinary chem. methods.

Separation of organic acids from plant tissues.

BULEN, W. A., VARNER, J. E., AND BURRELL, R. C. *Anal. Chem., 24,* 187 (1952).

The method reported uses an initial sepn. on a silica gel column followed, when necessary, by addnl. sepns. using both chromatographic and chem. technics. It provides for sepn. and tentative identification of 16 biol. important org. acids. This method has been applied to the sepn. and identification of acids in tomato fruits and Bryophyllum leaves. It should have applications in metabolic studies as well as in identification of acids present in a wide variety of biol. materials.

Examination of various vinegars.

SULSER, H., AND HOGL, O. *Mitt. Lebensm. Hyg., 42,* 403 (1951); *Brit. Abstracts, C,* 116 (1952).

Before analysis, the samples (5 ml.) are evapd. to dryness, and the residues are twice dissolved in 1 ml. of water, and evapd. to dryness; the final residue, dissolved in 1 ml. of water is used for analysis. The chromatographic technic is essentially as described in the previous paper. Wine, cider, whey, lemon, and acetic acid vinegars are distinguished by characteristic chromatograms. Tartaric and citric acids, sorbitol, fructose, glucose, glycerol, and hydroxymethylfurfural are detected. Cider vinegar (10%) is detected in wine vinegar. Unexplained observations are recorded.

Improved spray reagent for the detection of sugars.

MUKHERJEE, S., AND SRIVASTOWA, H. C. *Nature, 169,* 330 (1952).

Spots of a 1% soln. of sugars are put on filter paper, dried, and then sprayed with a soln. of p-anisidine phosphate in ethanol. Paper heated in an oven at 95-100° C. and within 5 minutes characteristic colorations appear. Different colors appear for aldohexoses, aldopentoses, sucrose, maltose, fructose, raffinose, and glucouromic acid. Polyhydroxy alcs. like sorbitol and mannitol do not give any color. Colors remain destructive for one week.

A method for determining low concentrations of oxygen in gases.

MCARTHUR, I. A. *J. Applied Chem., 2,* 91 (1952).

The method was developed primarily to det. the oxygen content of a plant gas, contg. 99% carbon dioxide but it is also suitable for use with other gases, e.g. hydrogen, nitrogen, and carbon monoxide. The amt. of oxygen is measured by passing the gas through a known volume of dil. acidified chromous chloride soln. and detg. the resultant change in chromous ion concn. The method can be applied to det. concns. of oxygen over a wide range. Its accuracy has been proved over the range of 5-55 p.p.m.

Colorimetric determination of benzene hexachloride.

SCHECHTER, M. S., AND HORNSTEIN, I. *Anal. Chem., 24,* 544 (1952).

Benzene hexachloride is dechlorinated to benzene in a special app. by means of zinc in acetic acid. The benzene is absorbed in a nitrating mixt. and converted to m-dinitrobenzene, which, after extn. is made to react with methyl ethyl ketone in the presence of strong alkali. The violet-red color which is produced is measured photometrically. As little as 5 γ of benzene hexachloride can be detd.

BIOLOGICAL SCIENCES

BIOCHEMISTRY

The chemistry and toxicology of the agene factor.

FORTMANN, K. L., PARKER, H. K., AND REINER, L. *Trans. Am. Assoc. Cereal Chemists, 9,* 1 (1951); *Chem. Abstracts, 46,* 637e (1952).

The isolation, identification, and synthesis of the agene factor is reviewed and identified as methione sulfoximine (I). The structure was confirmed by its synthesis from methionine sulfoxide and hydrazoic acid. I was found to be a methionine antagonist inasmuch as large doses of methionine prevented its convulsant action in mammals and reversed its growth inhibiting action in Leuconostoc mesenteroides, P-60. The chronic and acute toxicities of I and its diastereoisomers are discussed.

Absorption and toxicity of dieldrin.

BUNDREN, J., HOWELL, D. E., AND HELLER, V. G. *Proc. Soc. Exptl. Biol. Med., 79,* 236 (1952).

Dieldrin produced chronic toxicity in rabbits when it was applied once a week at 70 mg. per kg. body wt. Less than 30 mg. per kg. produced no symptoms. Only 2 of 11 rats dipped in 0.125, 0.187, and 0.250% Dieldrin spray solns. died. Dieldrin produced chronic toxicity in mature rabbits when fed orally approx. 60 mg. per kg. body wt. Similar feeding of approx. 150 mg. per kg. body wt. was fatal to rats. Liver and kidneys of all animals treated and analyzed were found to contain Dieldrin. The amt. recovered in these organs was generally in proportion to the amt. fed per week, not the duration of feeding. Analyses of milk from cows sprayed with Dieldrin for external parasite control indicated a max. of 5.9 p.p.m. which was gradually decreased regardless of continued application.

Chemicals in foods: A report to the association of food and drug officials on current developments. Part II. Pesticides section II. Dermal Toxicity.

LEHMAN, A. J. *Assoc. Food and Drug Officials, U. S., Quart. Bull., 16,* 3 (1952).

The approx. dermal toxicities for single and multiple exposures to about 40 pesticides are given. The results state that insecticidal materials which are solids or formulated as wettable powders and dusts are poorly absorbed through the skin and a single massive exposure may not be serious. At least, if prompt remedial procedures are invoked immediately after large quantities are spilled on the skin the chances of injury appear to be slight. Single massive exposures to insecticides which are liquid at ordinary temps. or solns. of solid materials in kerosene or other petroleum distillates, must be considered as dangerous.

(Continued on page 26)

[a] These Selected Abstracts are made available to FOOD TECHNOLOGY through the cooperation of Associate Editor H. A. Campbell and the General Foods Corporation of New York, N. Y. The abbreviations found in these abstracts are similar to those used by Chemical Abstracts.

FLAVORS

Through new low-temperature essence recovery techniques, developed in our laboratories, Alva natural fruit flavors possess greater fidelity, freshness and strength.

As a result of micro-analytical research into the components of natural flavors, we can also confidently offer superior fortified naturals and artificial flavors.

The Alva flavors division of van Ameringen-Haebler, Inc., can serve you best for any flavor need.

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Alva FLAVORS

reduce **RANCIDITY...**

increase **SHELF LIFE...**

with

NEW DIAMOND CRYSTAL Antioxidant SALT!

As you know, potato chips, prepared mixes, nuts, baked goods, powdered soups and many other products that are high in fat and low in moisture are often degraded by rancidity and the development of oxidative "off" flavors. And these factors limit the shelf life of many food products.

These problems may be avoided by the proper use of a new food grade antioxidant salt, developed as a result of years of laboratory research—Diamond Crystal Antioxidant Salt!

New Antioxidant Salt is as simple to use as common table salt. If sodium chloride is used in your processing, Antioxidant Salt will fit into your operation without extra equipment or labor.

Antioxidant Salt is economical, too! The additional cost involved in salting potato chips, for instance, is only about 7¢ per 100 lbs. of chips! This is a small cost to minimize returned goods.

The effectiveness, ease of use and economy of Diamond Crystal Antioxidant Salt will more than justify its test in your operation. Samples are available upon request. Send for yours right away! For further information, write to Technical Director, Diamond Crystal-Colonial Salt Division, General Foods Corporation, St. Clair, Michigan.

DIAMOND CRYSTAL Antioxidant SALT

Abstracts

(Continued from page 24)

Repeated daily skin exposure to insecticides, especially in soln., constitutes a real hazard. As a rule many of the materials in concd. formulations are skin irritants which serves as a warning of dermal contact. However, in dil. solns. this warning sign is lost and because of the delayed effects of a number of insecticides, serious poisoning may occur during the handling and application before the danger of poisoning is realized.

Intermediary metabolism of certain polyoxyethylene derivatives in man. I. Recovery of the poloxyethylene moiety from urine and feces following ingestion of polyoxyethylene (20) sorbitan monooleate and of polyoxyethylene (40) mono-stearate.

CULVER, P. J., WILCOX, C. S., JONES, C. M., AND ROSE, R. S. *J. Pharmacol. Exptl. Therap., 103,* 377 (1951).

A method is described for the detn. of the polyoxyethylene moiety in urine and feces following the administration of polyoxythylene (20) sorbitan monooleate and polyoxyethylene (40) mono-stearate. By means of balance studies on four hospitalized subjects there was shown to be a total recovery from the urine and feces of the polyoxyethylene moiety corresponding to the ingestion of 54-56 g. of polyoxyethylene (20) sorbitan monooleate over a 12 day period. The excretion of the polyoxyethylene moiety in the urine and feces of four medical students, each of whom ingested 54 g. or 72 g. of polyoxyethylene (40) monostearate over a 12 day period, was from 92.7 to 99.2% of the total intake. Under the conditions of the expt., the excretion was considered complete. From 3.9 to 5.8% and 2.3 to 3.1% of the polyoxyethylene moiety from polyoxyethylene (20) sorbitan monooleate and polyoxyethylene (40) mono-stearate, resp., was recovered in the urine. The remainder was recovered in the feces. The polyoxyethylene moiety recovered in the urine was free of combined fatty acid. There was no evidence of the storage of the polyoxyethylene compd. in the body.

MICROBIOLOGY

Heat reactivation of ultraviolet-inactivated bacteria.

ANDERSON, E. H. *Nuclear Sci. Abstracts, 5,* 918, 6047 (1951).

Ultraviolet-inactivated cells of several strains of *Escherichia coli* and *Saccharomyces cerevisiae* have been tested for their ability to be reactivated as a result of heat treatment after irradiation. The magnitude of reactivation obtained, with a 10° difference in incubation temp., for two strains of *E. coli* approximates that obtained by photoreactivation. The heat-reactivation phenomenon does not occur to any appreciable extent in x-ray-inactivated B/R cells and only slightly in B cells. Heat reactivation may not be as general a phenomenon as photoreactivation.

The survival of the Lansing strain of the poliomyelitis virus in ice cream.

BYRD, C. L. *Am. J. Digestive Diseases, 19,* 55 (1952).

The Lansing poliomyelitis virus suspended in ice cream was more resistant to heat than in saline suspension. Virus suspended in ice cream and kept in the refrigerator survived for 5 months, at room temp. for 4 months. This period was longer than the survival time of the same virus in saline. The number of variables which affect this type of expt. are, however, great. Thus a definite judgment about the thermostability of the Lansing poliomyelitis virus cannot be made readily. The most probable explanation for the prolonged survival of the Lansing virus in ice cream, however, is the phys. protective action of this food.

NUTRITION

More protein for pre-school children.

Science News Letter, 61, 156 (1952).

A diet deficient in protein prevents normal muscle development in pre-school children. Children with less than the best muscle mass are far more common than those with the normal amt. Generally the wt. is normal, since enough calories were supplied. The muscle mass of such children has been increased, in special expts. by as much as 25% without increasing the child's body wt. by feeding more protein. The protein deficient diets account for the poor posture commonly found at this age.

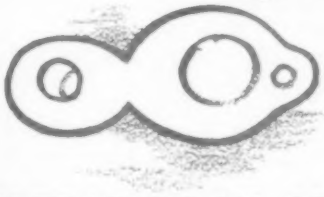
(Continued on page 30)

SOME FOOD FOR THOUGHT

...ON THE WORLD'S MOST AMAZING FOOD

ANHEUSER-BUSCH IS THE ONLY YEAST MANUFACTURER IN AMERICA PRODUCING ITS OWN DE-BITTERED BREWERS YEAST AND PRIMARY DRIED FOOD YEAST...BOTH COMPLYING WITH THE U.S. PHARMACOPOEIA.

DRIED YEAST IS AMAZINGLY RICH IN NUTRIENTS ESSENTIAL TO HEALTH AND VIGOR...IN FACT, THERE IS NO OTHER PLANT KNOWN TO MAN THAT IS AS RICH IN PROTEIN AND VITAMIN B CONTENT AS DRIED YEAST.



YEAST IS, BY ALL ODDS, THE SMALLEST OF CULTIVATED PLANTS — ABOUT 1/4000TH OF AN INCH IN DIAMETER TO BE SEEN, IT IS USUALLY MAGNIFIED ABOUT 600 TIMES.

ANHEUSER-BUSCH IS THE ONLY REGULAR PUBLISHER OF BROCHURES ON THE SUBJECT OF DRIED YEAST IN HUMAN NUTRITION. WE'LL GLADLY ADD YOUR NAME TO THE LIST FOR FREE MAILINGS...WRITE TO DRIED YEAST AND DERIVATIVES DEPT., ANHEUSER-BUSCH, INC., ST. LOUIS 18, MO.

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Abstracts

(Continued from page 26)

Studies on amino acids in self-selected diets.

FUTRELL, M. F., LUTZ, R. N., REYNOLDS, M. S., AND BAUMAN, C. A. *J. Nutrition* **46**, 299 (1952).

The essential amino acids were detd. microbiologically in the self-selected diets of 4 women. The total intake of amino acids always appeared to be greater when detd. on sep. foods than on composites. The greatest discrepancies were found with lysine, methionine, and tryptophan, with intermediate losses, observed for histidine, threonine, phenylalanine, and arginine. Values for leucine, isoleucine, and valine were similar whether made on the sep. foods or on the composites. The amts. of most of the essential amino acids consumed by the subjects were significantly higher than the levels recommended by Rose. Methionine, however, appeared to be limiting. Negative nitrogen balance seemed to be related to total protein intake, and also to the distribution of protein in meals throughout the day.

Effect of single amino acid excesses on glucose metabolism and chick growth as influenced by the dietary amino acid balance.

ANDERSON, J. O., AND COMBS, G. F. *J. Nutrition, 46,* 161 (1952).

Expts. were conducted to det. if the growth depression in chicks caused by feeding a high level of DL-lysine HCl, L-tyrosine, or DL-methionine could be overcome. The growth depression caused by the addn. of lysine was proportionally less when zein, corn, or addnl. gelatin was included in the diet. The growth depression caused by excess tyrosine was also less when addnl. gelatin was added. These proteins increase the level of other amino acids in the diet and thus appear to provide a more favorable amino acid balance. The growth depression caused by feeding excess methionine was not influenced by adding arginine or gelatin, even though these make a better dietary amino acid balance.

Meatless diet adequate.

Science News Letter, 61, 70 (1952).

Both vegetarian and carnivorous types of diet are adequate to feed mankind. Milk and other foods of animal origin are not necessary for nourishment. Diets should be built around the nourishing foods of a region. The fact that a particular nutrient is supplied is more important than its source.

The replacement value of the Alaska field pea (Pisum sativum) for human subjects.

ESSELBAUGH, N. C., MURRAY, H. C., HARDIE, L. W., AND HARD, M. M. *J. Nutrition, 46,* 109 (1952).

The replacement value of the protein of the Alaska split pea *(Pisum sativum)* has been compared with that of egg protein. Six young adult women served as subjects. Pea protein was slightly less efficient than egg protein for the human adult subject. The av. daily nitrogen balance on the egg diet was —0.10 g., while that on the pea diet was —0.31 g. This difference was not statistically significant. The egg replacement value of the pea protein was found to be 95.1%. This indicates that the split pea is a protein food of high biol. value for human consumption.

Effect of aging and various types of breakfasts on the blood sugar level.

BRYANT, K., MARTIN, C., SCHUMACHER, M. T., DAUM, K., AND TUTTLE, W. W. *J. Am. Diet. Assoc., 28,* 17 (1952).

On the basis of data collected from a group of men ranging in age from 20 to 30 years and another group of men ranging in age from 60 to 84 years, relative to their blood sugar response following different types of breakfasts, the following conclusions are drawn: a) The blood sugar level following breakfast

(Continued on page 32)

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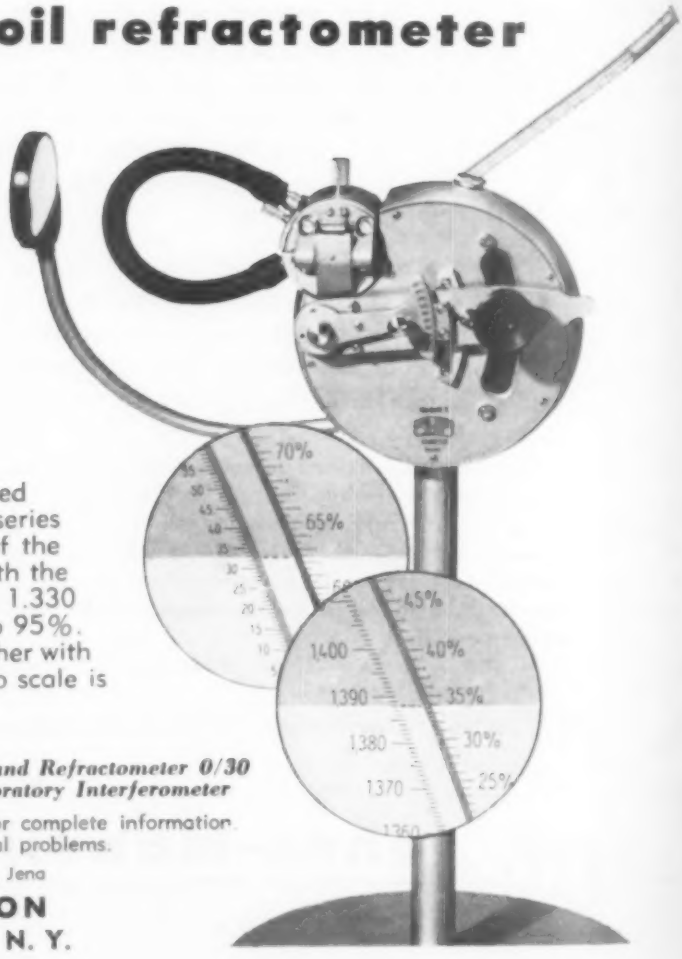

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Abstracts

(Continued from page 30)

is significantly affected by the amt. of protein in the meal. In this expt. 10 g. were not sufficient to maintain the level 3½ hr. after the breakfast at, or above, the fasting level. However, 25 g. protein were found to be adequate in this respect. b) The effects of the protein in the breakfast on the blood sugar level following the meal were the same regardless of whether it was of plant or animal origin. c) Both the younger and the aged group experienced the same blood sugar changes following similar breakfasts.

Super-good growing diet may worsen chronic ills.

Science News Letter, 61, 57 (1952).

Combinations of food that seem to provide adequately for growth may tend to accentuate certain chronic ailments commonly associated with old age. This idea is based on rat nutrition studies made by the U. S. Bureau of Human Nutrition and Home Economics. The rat's response to diet may not be identical with that of man.

Effect of aureomycin and penicillin upon the vitamin requirements of the rat.

SAUBERLICH, H. E. *J. Nutrition, 46,* 99 (1952).

Studies were made on the effect of aureomycin and penicillin upon the growth of weanling rats fed diets deficient in certain B vitamins. The addn. of penicillin to the diet (0.01%) caused a marked stimulation in the growth of rats fed diets free of or low in thiamine, pyridoxine, pantothenic acid and, to some extent, riboflavin. Aureomycin (0.01%) had a similar effect in the case of pantothenic acid and thiamine deficiencies. The effect of the antibiotics on thiamine and pyridoxine deficiencies was evident whether sucrose or dextrin was used in the diet. The inclusion of penicillin or aureomycin in the completely vitamin-supplemented basal diet had no effect upon the growth of the animals.

A mode of action of antibiotics in chick nutrition.

COATES, M. E., DICKINSON, C. D., HARRISON, G. F., KON, S. K., PORTER, J. W. G., CUMMINS, S. H., AND CUTHBERTSON, W. F. J. *J. Sci. Food Agr., 3,* 43 (1952).

Procaine penicillin [penicillin (procaine salt)] added to a good practical ration improved the growth of chicks in a lab. used for poultry for ten years. Chicks from the same batch in two other labs., where birds had not been kept before, grew equally well on the ration with and without penicillin, and growth was the same as that on the penicillin-supplemented diet in the usual chick lab. The growth depression in the absence of dietary penicillin was not due to differences in management or to recognizable disease. It is suggested that it is due to an "infection" hitherto undescribed and shown to be transmissible and counteracted by penicillin.

Detergents speed growth.

Science News Letter, 61, 164 (1952).

Certain surface active agents, including com. prepns. for home and laundry use have promoted increases in growth ranging to 12% above controls when added to standard diets of chickens. In other tests with hogs ethomid, a surface active agent, resulted in a wt. gain of nearly 1.3 lbs. per day while controls gained only 1.1 pounds per day. The possible methods of action advanced are that they restrain or destroy certain bacteria in the intestine, and that the wetting properties cause the nutrients in chick feed to be assimilated more rapidly in the intestine.

Effect of raw soybean meal on growth of the chick.

ALMQUIST, H. J., AND MERRITT, J. B. *Proc. Soc. Exptl. Biol. Med., 79,* 277 (1952).

The results of feeding varying proportions of raw to cooked soybean meals are explainable on the basis of an antitrypsin

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which inhibits trypsin but permits the remaining proteolytic system to function at lowered efficiency. Further slight inhibition of growth with increase of raw soybean meal may be due to decreased availability of the nutrients in the raw meal.

Vitamin B_{12}. Part 1.

SMITH, E. L. *Nutrition Abstracts and Revs.*, *20*, 795 (1951).

A review of B_{12} covering its history, chemistry (as known to date), prepn. of radioactive forms, methods of assay, sources (in nature), amts. required by chickens, pigs, rats, mice, dogs and other mammals, its pharmacology, and mode of action.

Effect of methylcellulose on growth response of rats to low vitamin intakes.

ELLINGSON, R. C., AND MASSENGALE, O. N. *Proc. Soc. Exptl. Biol. Med.*, *79*, 92 (1952).

Daily ingestion of methylcellulose does not significantly decrease the effectiveness of (1) thiamine hydrochloride in the depleted or normal rat, or (2) vit. A in the A-depleted rat. These data are interpreted to mean that daily ingestion by the rat of large amts. of methylcellulose does not decrease the absorption of water-soluble or oil-soluble vitamins, and therefore does not increase the daily requirement of the rat for these factors.

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Sept. 9-13	Seventh National Chemical Exposition, ACS., Coliseum, Chicago, Ill.
Sept. 14-19	122nd National Meeting, American Chemical Society, Atlantic City, N. J.
Sept. 29-Oct. 1	Association of Official Agricultural Chemists, Annual Meeting, Shoreham Hotel, Washington, D. C.
Oct. 20-22	Fall Meeting, American Oil Chemists' Society, Cincinnati, Ohio.
Oct. 20-22	Annual Forum, Packaging Institute, Hotel Commodore, New York, N. Y.
Nov. 17-20	American Bottlers of Carbonated Beverages, Annual Convention, Atlantic City, N. J.
Dec. 28-31	119th Meeting, American Association for the Advancement of Science, St. Louis, Mo.

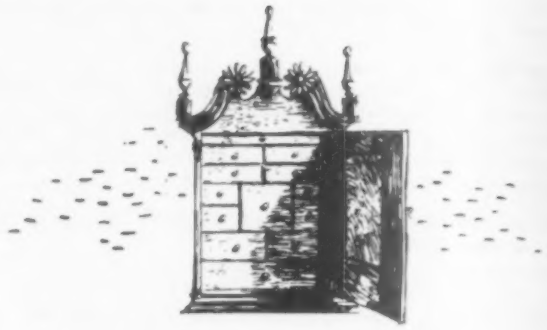
1953

June	**Institute of Food Technologists, Thirteenth Annual Meeting, Boston, Mass.**

(Information concerning future dates of national and international meetings, conventions and exhibits of interest to food technologists should be sent to the editorial office.)

Advertisers' Index

	PAGE
Anheuser-Busch, Inc.	27
Brewers Yeast Council, Inc.	35
Continental Can Co.	4-5
Distillation Products Industries	1
The Diversey Corp.	9
Dodge & Olcott, Inc.	8
Ercona Corp.	30
Felton Chemical Corp., Inc.	3rd cover
Florasynth Laboratories, Inc.	34
Food Development Laboratory	36
Food Machinery & Chemical Corp.	4th cover
Food Research Laboratories, Inc.	36
Fritzsche Bros., Inc.	36
General Foods Corp. (Diamond Crystal Salt)	26
Givaudan Flavors, Inc.	18
The Griffith Laboratories, Inc.	11
Johns-Manville	29
Kiwi Coders Corp.	36
LaWall & Harrisson	32
Magnus, Mabee & Reynard, Inc.	2
Merck & Co., Inc.	31
Minneapolis-Honeywell Regulator Co.	20-21
Norda Essential Oil & Chemical Co.	32
The Pfaudler Co.	2nd cover
Chas. Pfizer & Co., Inc.	13
Rohm & Haas Co.	17
Schwarz Laboratories, Inc.	33
Seaplant Chemical Corp.	33
Foster D. Snell, Inc.	36
A. E. Staley Mfg. Co.	7
Sterwin Chemicals, Inc.	15
Tennessee Eastman Corp.	19
U. S. Stoneware Co.	23
van Ameringen-Haebler, Inc.	25
Vegetable Juices, Inc.	33
Wallace & Tiernan Co., Inc.	35



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Crab meat was canned in 20 plants in Washington, 17 in Alaska, 8 in Oregon, 3 each in Mississippi and Louisiana, 2 each in Maine and California, and 1 each in North Carolina, South Carolina, Georgia, and Alabama. [*Com. Fisheries Rev.*, 13 (9) 15 (1951) September.]

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Awards and Honors

NICOLAS APPERT AWARD PRESENTED TO EDWARD MACKAY CHACE, 1952 MEDALIST

At the Appert Award Banquet, given June 10, 1952, in the Black and Silver Room, Civic Auditorium, Grand Rapids, Michigan, during the course of the Twelfth Annual Meeting, Edward MacKay Chace, distinguished "dean of citrus products technology," was presented the Nicolas Appert Award medal. On behalf of the Chicago section, which established the award eleven years ago as a means of recognizing scientific achievement in the field of food technology, Mr. Virgil O. Wodicka, chairman of the Chicago section, made the presentation speech.

The two papers that follow are traditional features of the Appert Award ceremony. The first, delivered by Mr. A. J. Lorenz, a friend of long standing, introduced the honored recipient of the award. The second is the response of the recipient, Edward MacKay Chace, to the distinction conferred upon him by the Appert Award committee of the Chicago section. The addresses add vivid background to the history of food technology.

EDWARD MACKAY CHACE: EXPLORER OF THE HESPERIDES

The limitations which friendship imposes make it difficult for me to follow tradition. I cannot bring myself to recite cold biographical details. They are printed in the banquet program. What I am to say, however, may take you quite away from the true significance of Mr. Chace's contribution to food technology, particularly the technology of citrus fruits which he pioneered.

However, the real dean of citrus technology was Mar Sergius, a Nestorian Christian missionary, who journeyed to the court of Kublai Khan 700 years ago. In hope of winning the Mongol Emperor's favor, and permission to proselytize China, Mar Sergius brought with him from Persia a jar of "She-li-pah," the "Sharbat" of the Arabs. This She-li-pah tickled the Khan's palate so that he awarded the Christian missionary a gold tablet—the first award for food technology in history! In addition, Kublai Khan elevated Mar Sergius to the cabinet rank of "She-li-pachi," or royal sherbet-maker. He was commanded to produce forty jars of the fruit juice a year to preserve the Emperor's health. Incidentally, Mar Sergius' "She-li-pah" was not sherbet as we think of it today, but a sweetened lemonade base.

There is a moral to this historic fact, namely, that Mar Sergius had better success as a food technologist than as a missionary. In the same year, 1268, history records, Kublai Khan established Buddhism, not Christianity, as the state religion of China.

Today's Nicolas Appert Medal, fortunately, carries no such dire responsibility with it—of having to serve in the cabinet.

Citrus technology flourished even earlier in Southern China. A ninth century Chinese poet named Tung Po describes orange juice as "This is the spring-colored wine of Tung T'ing, worthy of silver flagons and turquoise ladles, of purple gauze and green silk wrappings."

Perhaps I shall also regret indulging my whimsy, referring to Mr. Chace as "Explorer of the Hesperides." But, in our zeal for the application of scientific knowledge we have become so indoctrinated with realism, to the exclusion of all capacity for wonder, that we have no time left for mythology or legend, the pre-history of the very things we work with. After all, how can the modern food technologist, using nuclear physics in an attempt to preserve orange juice, have room left in his brain for the story of the Golden Apples of the Hesperides? The Hesperides contained the primordial citrus grove. It was entrusted to the care of three beautiful maidens: Aegle, the Citron, Arethusa, the Lemon nymph, and Hesperethusa, the Orange. All were guarded by a fearsome dragon who first had to be overcome by Hercules to enable him to steal the golden fruit, the fruit from the trees which Juno, queen of the gods, had given to Jupiter, as her dowry. Mr. Chace wisely chose citrus fruits, with their romantic and aristocratic background, for his technological career.

But, whenever we in Los Angeles think of his early and fundamental maturity studies, setting the standard on an objective chemical basis, the ratio between acid and soluble solids, we are compelled to remember the original Fruit and Vegetable Products Research Laboratory of the U. S. D. A. on Mission Road, housed in a ramshackle, corrugated iron complex of sheds. In humility, however, we are reminded of Charles Kettering's boast that he "researched and built the automobile self-starter in a hayloft, and that ethyl gas was developed on the second floor of a tobacco warehouse."

Fortunately, there is now a spacious new citrus research laboratory in Pasadena which affords opportunity both for fundamental and applied research.

The full development of applied research depends on the existence of a large reserve of previously unexploited knowledge, fundamental research which is the investigation of natural phenomena with indifference to utilitarian ends. Chace's laboratory provided the bridge between the two. His work and that of his associates pointed out the need for more fundamental knowledge to speed the applied technology. In a great measure, Chace and his associates, therefore, helped to lay the foundation for the regional laboratory idea. These laboratories are better serving agriculture's needs today for a more fundamental knowledge of products of soil and sun.

Chace had to provide most of his own store of fundamental knowledge on citrus. He weeded a welter of empiric, almost folklore, practices and gleaned from them hardy scientific facts. For reliable data on lemon oil, he went to Sicily in 1908 to be certain of obtaining unadulterated samples, at the source, for analyses which would guide the American producer and consumer, by insuring a standard product.

(Continued on page 6)

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CONTENTS

QUALITY AND NUTRITIVE PROPERTIES OF DIFFERENT TYPES OF COMMERCIALLY CURED HAMS. 1. CURING METHODS AND CHEMICAL COMPOSITION. M. D. Fields and C. F. Dunker 329

RAPID VERSENATE METHODS FOR DETERMINING CALCIUM IN SOLUTIONS AND FRUIT AND VEGETABLE TISSUE FOR QUALITY CONTROL. C. C. Strachan and A. W. Moyls 333

THE DEFROSTING METHOD AND PALATABILITY OF POULTRY. Eugenia Hoffert, Alma R. Plagge, Belle Lowe, and George F. Stewart 337

FUNGAL ENZYMES IN BREAD BAKING. Gerald Reed 339

EFFECT OF FREEZING AND THAWING ON THE GROWTH RATE OF BACTERIA IN GROUND MEAT. William L. Sulzbacher . . 341

THE ROLE OF SANITATION IN QUALITY CONTROL OF FROZEN CITRUS CONCENTRATES. Charles H. Brokaw 344

EXAMINATION OF CITRUS JUICES PROCESSED FROM PARATHION-SPRAYED FRUIT. R. W. Olsen, C. R. Stearns, Jr., and R. Hendrickson 350

TOXICITY TESTING OF CHEMICAL ADDITIVES. Elliott A. Maynard 351

AN ACCELERATED CURE FOR BACON. Verlin K. Johnson and Sleeter Bull 354

THE FUSEL OIL CONTENT OF CALIFORNIA WINES. James F. Guymon and Joseph E. Heitz 359

EXPERIMENTAL PRESERVATION OF FLESH FOODS WITH ANTIBIOTICS. H. L. A. Tarr, B. A. Southcott, and H. M. Bissett 363

FILLETING FISH AND FREEZING FILLETS. James M. Lemon . 366

THE EFFECT OF HOMOGENIZATION AND COMMINUTION ON CAKE BATTERS. E. C. Edelmann and W. H. Cathcart . . 368

FLAVOR QUALITY AND STRENGTH OF PROPENYL GUAETHOL AS A VANILLA EXTENDER OR REPLACEMENT. L. C. Cartwright and Patricia H. Kelley 372

AWARDS AND HONORS *2*

REGIONAL SECTION NEWS *16*

SELECTED ABSTRACTS *18*

NOTES AND LETTERS *24*

BOOKS *30*

Authors of papers intended for publication in FOOD TECHNOLOGY should request from the editorial office a copy of the booklet, entitled "Information and suggestions to authors." Manuscripts submitted for publication in FOOD TECHNOLOGY should follow the style described in this booklet.

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Awards and Honors

(Continued from page 2)

Failure to recognize the vital service of fundamental research underlies the vociferous demands made in certain quarters for government control of all research, either direct or through subsidy. Such control would to a large extent defeat its avowed object. Who among us can issue sure directions for an untraveled path leading to an unknown destination?

Direction is practicable, but only in the fields of applied science which is orientated ultimately by considerations of the problems of supply and demand. Chace seemed to have anticipated these problems of the rapidly growing citrus industry. For example, he began to develop frozen juice many years before retail outlets were ready for the distribution of the product. Again, by hanging out a lantern, Chace gave the industry direction.

Pioneers like Chace had need for a broad outlook to overcome the deficiencies of their laboratories. The chemist and food technologist of today are far better equipped in laboratory facilities and even in scientific training, than their predecessors. As one reads the papers and articles Chace and his associates published it becomes apparent that he had this broader outlook within his laboratory as well as in the wider field of human affairs, in his dealings with industry. He never thought or acted parochially.

Chace's legal training, in addition to his chemical training, served him well. As in law, Chace realized that the progress of food technology depended on "cumulativeness," and the vastly accelerated rate at which new facts could be accumulated. Progress, he knew, was dependent on a quick exchange of sound ideas between government and industry.

Chace always cooperated to the fullest extent with industry, with civilian enterprise. This exchange of ideas, which brought about a sense of mutual trust, is everywhere evident. I have read it in the letters in our own files and the files of other industries with which he worked. This sense of mutual trust created fuller and quicker utilization and realization of accomplishment, the teaming of science and engineering.

It is a common experience to have a sudden conviction that something has happened before, though we cannot remember where, or that a place, seen for the first time, is mysteriously familiar. This is not clairvoyance, or what some psychologists probably term "remembering the future." Conspicuous in Mr. Chace's address tomorrow will be his modesty and candor. He has always refused to throw scientific dust into anyone's eye. He never regarded it as honest to conceal ignorance—either his own or another's. Sooner or later, he has often said, someone would have discovered the same things he did, set the same fruit maturity standard, someone would have applied ethylene to the coloring of fruit and loosening of the walnut hulls.

Both of these are the subjects of the "Research Achievement Sheets" currently published by the U. S. Department of Agriculture's Agricultural Research Administration. I shall quote only one paragraph from the April 1952 Achievement Sheet:

> "Status and Application: The 8-1 maturity standard for oranges was adopted by the Federal Bureau of Chemistry in 1916 as the standard of maturity for interstate shipment. The citrus-growing states adopted it as a standard for oranges grown and sold within their borders. During the thirty-five years since its adoption, this standard has never been successfully challenged."

Certainly this is an enviable record for either a lawyer or a chemist.

One of the officials in the Bureau of Chemistry with which Mr. Chace was associated recently said to me:

> "I defy anyone to suggest a problem relative to the processing of fruits and vegetables which has not at some time been touched on by Chace during the forty-five years he was in our Bureau."

So you can see why it is not easy to give, briefly, an adequate idea of the amount of work done by the 1952 Appert Award medalist. He became the authority in citrus technology by virtue of the definition that: "An authority is a fellow who knows the facts." He shared his facts with industry and enriched food technology.

Mr. Chace, your fellow Californians, both North and South, are proud of your achievement and this honor which comes to you. I am sure the citrus technologists of Florida, Arizona and Texas, and all food technologists, join me in a figurative toast to you in the "Spring-colored wine of Tung T'ing!"

ADVENTURES IN EARLY FOOD TECHNOLOGY

by

EDWARD MACKAY CHACE

The honor which has been bestowed upon me in selecting me as the Appert Medalist for this year is greatly appreciated. Some of my oldest and best friends have received this award, and it is a pleasure and a privilege to join that group. I was somewhat startled when I read the program and learned that I was supposed to give an "address." Instead, I thought I would go back over some of my sixty years of experiences and relate some of them and what happened during that time.

When I joined the Bureau of Chemistry, Dr. Harvey Wiley was in the midst of his campaign for the passage of the Food and Drug Act. Congress had given permission and money for the old Division of Chemistry to install several laboratories at the big import centers throughout the country for the purpose of testing and refusing entry to any food products considered to be either adulterated or misbranded. Shortly after this, the laboratory at New Orleans refused entry to a consignment of vinegar labeled "taragon vinegar" imported from France. Under the rules Dr. Wiley had set up, any material labeled vinegar must conform to the standards for cider vinegar. Other vinegars were not prohibited but they had to be labeled to show their origin, such as wine vinegar, pear vinegar, etc. The material offered at New Orleans was promptly refused admission on the grounds that it was misbranded, that there was no such vinegar as taragon vinegar and that the product must be labeled either wine vinegar or spirit vinegar, flavored with taragon, as taragon could not be made into a vinegar but was only an added fla-

(Continued on page 8)

Blue pike and vitamin A_2

The vitamin A in the livers of blue pike and other fresh-water fishes differs by a few significant details in its chemical structure from the vitamin A found in marine fishes and in species that migrate between fresh and salt water. The fresh-water variety is vitamin A_2, and some years ago we decided to investigate it thoroughly.

We made arrangements with a local fish market to set aside 150 pounds of pike livers for us. Not quite trusting the harried lads in their back room, we checked the livers under ultraviolet, using the fact that A_1 fluoresces in brilliant yellow and A_2 in brownish orange. Thus we screened out a few ringers that had been tossed into the barrel. Then after a lot of work our chemists came up with crystallized vitamin A_2—the first ever produced.

Since blue pike and the rest of the A_2 group can see farther into the infrared, this involved us during the war in a project to sensitize the eyes of military personnel to infrared signalling. The experiment had only limited success, but we learned more about the absorption and metabolism of A_2.

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Awards and Honors

(Continued from page 6)

vor. The French refused to re-label their product and took the matter up with their ambassador in Washington. At this time, President Teddy Roosevelt had what was called locally a tennis cabinet; this group met on the White House grounds sunny afternoons to enjoy a set or two of tennis with the President, and among those attending was the French ambassador.

Shortly after the shipment of the alleged taragon vinegar had been refused entry at New Orleans, the Secretary of Agriculture (at that time "Tama Jim" Wilson of Iowa) received a note from the White House directing him to have the man at New Orleans who had held up the importation fired. Of course the Secretary of Agriculture immediately sent the White House note to Dr. Wiley, who endorsed it as follows: "This man at New Orleans was acting under my direct orders, and if anyone is to be fired it should be me." The Secretary returned the note to the White House and in a few days it was back in Agriculture with a notation under what Dr. Wiley had written saying: "Mr. Secretary, you say when . . . T. R."

At that time there was a man in the Bureau of Chemistry named Andrew Mitchel. He was personally acquainted with Secretary Wilson, had been a Food Commissioner in one of the mid-western states and knew many of the congressmen from those states. The Secretary called Mitchel to his office and discussed the whole matter with him. They decided to postpone any action until they could talk with some of the Republican leaders in Congress. It was thought that the President did not realize how great a following Dr. Wiley had, and as this was an election year they wanted no political disturbance in any of the crucial states, so the suggestion was made and carried out, that as long as Teddy Roosevelt had given no direct order to fire Wiley that the letter from him be left "status quo." As nothing further was heard of the matter Dr. Wiley remained in office until Mr. Taft became President and finally resigned to take over a job with *Good Housekeeping* magazine. I did not know about this affair until several years afterward, Mitchel and I having become very close friends in the meantime. But that was one time the "Big Stick" did not work.

I am always curious how projects get started and what determines the field in which a man finds himself without realizing just how he got there. My connection with citrus fruits came about in a curious way. When I was analyzing food samples a lot of flavoring extracts were given me for testing. This led to examining essential oils and to the discovery that turpentine was being used as an adulterant in lemon oil. More than mere traces of the terpine pinene were present in most of the samples examined. Pinene is the terpine of terpentine while limonene is the terpine of lemon oil. The trouble was that traces of pinene had been reported in lemon oil and we were never sure that our samples, used for comparison, were genuine.

I was sent to Sicily to procure authentic samples. The following year G. Harold Powell, afterwards manager of the California Fruit Growers Exchange, visited the lemon growing districts of Italy and upon his return asked me to write up a part in a bulletin he was going to publish on the Italian lemon industry; my part was to be on lemon by-products. When this pamphlet was published the California lemon growers asked that someone be sent to California to explore the possibilities of by-products from their lemons.

I was sent to California and prepared a few samples of oil from California lemons for we were not at all sure it would compare favorably with oil from Italian lemons. The samples were sent to Washington and analysis showed the oil compared very favorably with that from Italian lemons. The Bureau then set up a small laboratory and assigned two men to it. These men in later years were with the Sunkist organization and remained there until their retirement a few years ago.

Before the laboratory at Los Angeles was well under way, another incident occurred which handicapped our efforts on citrus products.

The Food and Drug people seized and had condemned several carloads of oranges on the ground they were too green for human consumption. Immediately the orange growers asked the Department to set a standard by which they could tell whether their fruit would be considered ripe by the Food and Drug people before they shipped it. Again I was sent to California and for two years we worked with oranges trying to find a maturity standard. After thousands of analyses we finally hit upon what we thought would be a fair standard for the different orange growing sections. The standard was based on soluble solids contained in the juice and the citric acid. The ratio was set at eight parts of soluble solids to one part of anhydrous citric acid. The standard was arrived at by correlating the consumer acceptance, the volume of the shipments, and price paid. In this way we were able to arrive at what would be an acceptable orange to the Eastern public. Of course, the standard raised numerous criticisms. Part of the industry thought that the standard was too liberal, while in the northern part of California, they declared they would have to go out of the orange growing business if the standard was adopted. It was adopted, and the fun began in the northern counties of California. The growers there conceived the idea that the Department of Agriculture was in league with the growers of Southern California and trying to keep the fruit of the northern counties out of the market so it could be taken over by the Southern Californians. Someone always makes the mistake, and one of the associations in Northern California shipped a box of oranges to the Secretary of Agriculture to show what fine fruit would be kept from the market if the regulation was kept in effect. Unfortunately for them the Secretary's wife reported to him that if she had purchased those oranges on the market she would have promptly returned them and demanded her money back as they were too sour to eat.

The test, however, was generally accepted by the orange industry and has now been in effect for some thirty-five years with some modification, and is still meeting with general satisfaction. This, of course, led

(Continued on page 10)

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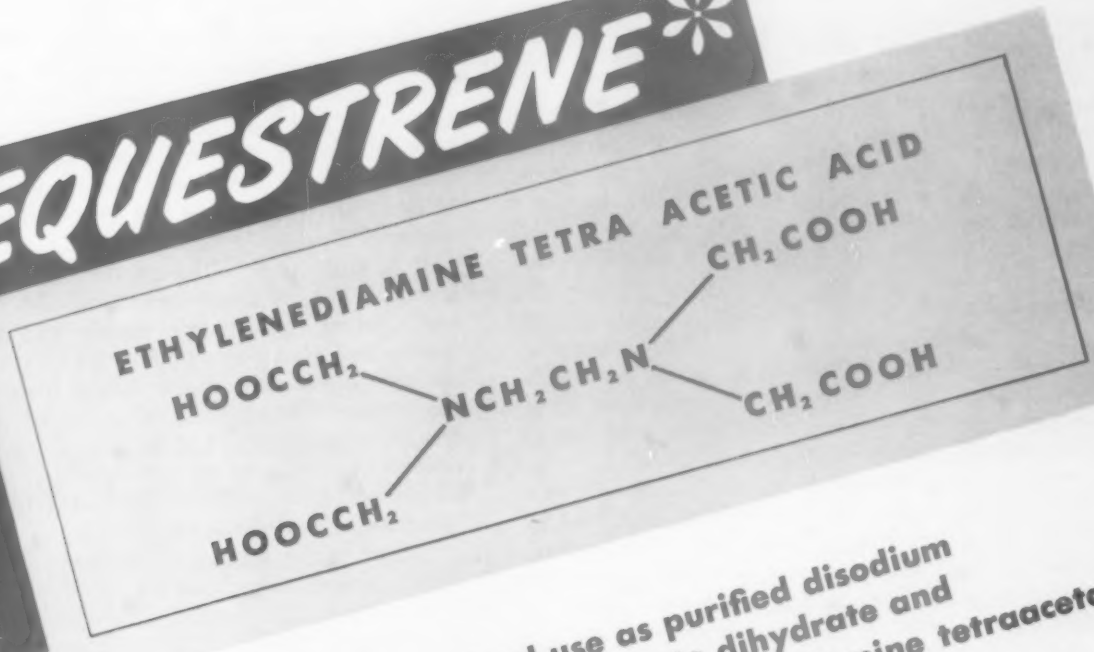

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Awards and Honors

(Continued from page 8)

to requests from other fruit industries for testing the maturity of their fruit. Unfortunately there were no very strong growers' associations outside of the citrus industry and no one was interested enough to push the maturity test which was given them into general adoption. We worked for two seasons in the Imperial Valley on cantaloupes. The temperature during the cantaloupe season runs from the high nineties to 120 degrees F. After two seasons' work the growers at one of their "get-together" meetings adopted a standard much lower than the one we recommended, their only reason being "Government men always set standards too high."

In working with oranges in Central California one was immediately struck with the crude method used to accelerate the color of early shipments. This method went back a good many years and came about in a rather curious way. This part of California is likely to experience cold spells and several times the oranges were damaged on the trees. In order to avoid the loss from this freezing weather it became the custom to store the fruit in packing houses until it was ready for shipment. Even then the fruit was hurt by excessively cold weather while being stored. Then they began to heat the packing houses, the most convenient method being with kerosene stoves. Heating by these stoves colored fruit much more evenly and quickly than that which had been stored in unheated or steam-heated houses. The method of using kerosene stoves in the packing houses then became widespread.

The fruit was brought in in lugs and stacked in rooms where two or three kerosene stoves were burning. The idea became prevalent among the packing house foremen that the more vile smelling and tear compelling the air in these rooms the better the color of the fruit. This was entirely wrong as we were able to show them later. Of course, at most inopportune times the stoves would start smoking or start fires, so a watchman had to make inspections every hour or two. The Bureau of Chemistry finally decided to investigate this process and put in a man well suited for the post. He soon discovered that the active agent in the combustion gas was an unsaturated hydrocarbon. Then he tried the most common of the gases of this class as reported in the literature. It soon became evident that ethylene was by far the best reagent, and very soon we were able to report that we were ready for large scale tests.

Then the question arose as to who would be responsible for any damage done in these large scale tests. We were sure there would be no damage, but we wanted to make certain that if there was any, the fruit growers would be compensated for the injury. It was suggested by some of the associations that we approach the Lemon Men's Club, an organization composed of lemon growers belonging to different shipping organizations. This was done and we were guaranteed a sum of two thousand dollars to compensate growers for any injuries that the test might cause. The club also put up another one thousand dollars for expenses which could not be borne by the Bureau. We made the test first in a large lemon packing house at Whittier, California, and were able to report that it was entirely successful and that no damage had occurred to the fruit. We made the final report to the Lemon Men's Club and very soon were busy reporting on many houses that were trying out the method for coloring lemons.

It is still in use although the application has been changed to some extent by introducing the trickle system: letting the ethylene trickle into the ventilating system and pass over the fruit in this way. We were somewhat dubious as to the danger from the use of this gas because it is explosive when mixed with six to sixteen parts per hundred of air, but as we were only recommending one part in one thousand, we thought the leeway was quite sufficient. Notwithstanding this, there were one or two minor explosions.

Owing to the success of the method with citrus we began experimenting with other fruit. We found that it could be used in softening pears for canning. These pears are always harvested when green-ripe and placed in cellars for softening until satisfactory for canning. Experiments showed that after five to six days' treatment with the gas they were sufficiently soft for canning; moreover, the fruit softened uniformly and required less sorting than lots stored in the usual way. During one season about nine thousand tons of pears were treated.

The next large scale experiment was carried out with English walnuts. At that time, Southern California had a large acreage of these nuts. The plantings in the interior were often subjected to high temperatures at harvest time. This not only caused the hulls to stick to the nuts, but tended to darken the kernels. Walnuts are graded on the color of the kernels and nuts with dark kernels are placed in a lower grade than those with lighter ones.

The nuts that still retain a portion of the hull after going through the huller are termed "sticktights." Formerly these "sticktights" were placed in burlap bags and thoroughly soaked in water, after which they were allowed to remain under the trees for several days before being run through the huller again. This treatment helped the "sticktight" problem, but the percentage of dark kernels and mildewed nuts was markedly increased.

It was found that treatment with ethylene for five to six days would cause the hulls to become friable so that the hulling machine did an almost perfect job. The method greatly increased the grade of nuts from certain regions where it had been almost impossible to produce light-colored kernels. Cases were reported where the average yield of first-grade nuts had been raised from twenty to eighty per cent. The use of ethylene has now become widespread; tomatoes, bananas, honeydew melons, and other fruits are being treated. At one time someone recommended its use for blanching celery. We did some work with Utah celery but were never able to get what we thought were satisfactory results.

At one time our laboratory became greatly interested in frozen fruit pulps. We had no adequate freezing

(Continued on page 12)

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Awards and Honors

(Continued from page 10)

equipment so we built an insulated tank containing a bunker for dry ice. Alcohol was circulated over the dry ice and temperatures of eighty to ninety degrees below zero were attained. Fruit was prepared, pulped in a fine grinding machine and sweetened. The pulp was sealed in tight containers and immersed in the circulating alcohol. Naturally, a very rapid freezing ensued at once and the pulps were not icy but smooth in texture and retained the natural flavor of the fruit to a remarkable degree. I took a variety of these pulps with me on a trip East and exhibited them while the National Canners Association was in convention at the Stevens Hotel (Chicago). The canners were not very pleased with the exhibit. At that time any frozen food excepting ice cream seemed to give them the jitters. I had a hard time convincing the people who tasted these pulps that some of them were not artificially flavored. One lady finally remarked that if the pear sample was not artificially flavored she was of the opinion that it tasted more like pears than pears did.

While these pulps were not a commercial success, the project did start at least one firm in Los Angeles in business making frozen fruit pulp for use in flavoring ice cream and now this is the generally accepted flavoring method.

Being located in California, it was inevitable that we should be subjected to the sun-dried fruit problem. This problem sounds very simple; it was to produce with a lowered amount of sulphur a dried fruit which would have an appearance equal to that of the highly-sulphured fruit then on the market.

This industry in California, at least at the time we were engaged in the work, was something of a small orchard industry. The grower harvested his fruit each day and his children and the neighbors' children pitted it and placed it on trays. The fruit was placed hollow side up, sprinkled with water and the tray put on a truck. When filled, the truck was run into the sulphuring house and the doors tightly closed. Before retiring at night the grower would place a supply of sulphur in an open kettle, light it and close the doors again. Then he went to bed and in the morning he had a fine lot of over-sulphured fruit. He was not entirely to blame for this practice. The dried fruit association would pay on the commercial quality of his product and that quality was enhanced by a translucent appearance and bright color. While I believe we were able to offer some valuable suggestions to the growers, the problem has never yet been solved so far as I know, although the amount of sulphur dioxide retained in the fruit is less than formerly.

Good keeping quality and good appearance are apparently dependent on the amount of sulphur which the fruit absorbs. Of course, most of this fruit is cooked before being eaten and undoubtedly a considerable part of the sulphur compound is driven off in this way.

The last project in which we engaged while I was still with the Bureau was that of dehydration. Primarily this was an engineering problem and the chemist is only incidental.

After World War I when Dean Prescott left the service and went back to MIT the entire force engaged in dehydration work, together with the apparatus, was shipped to the Los Angeles laboratory, and we struggled along for a season or two before the appropriation was discontinued. At the beginning of World War II the subject again came up and the Western Regional Laboratory was chosen as the site for the operations. Again it became evident that this project is largely one for engineers. However, we worked along as best we could with many delays and obstacles to overcome. As in the case of frozen food when the commercial installations first start, there are many who know little about the process they are getting into, believe it is a good money-making proposition, and therefore are anxious to get into it early in the game. Many small and inadequate dehydrators were started up and, of course, much inferior material was produced. In one case, which I recall, we were in a dehydrator working on carrots. They were packing the carrots in cans and filling the space between the dehydrated food pieces with an inert gas. This was done by a girl worker who shoved a tube to the bottom of the can, turned a valve and after counting so many seconds, turned off the flow of gas and sent the can to the sealing machine.

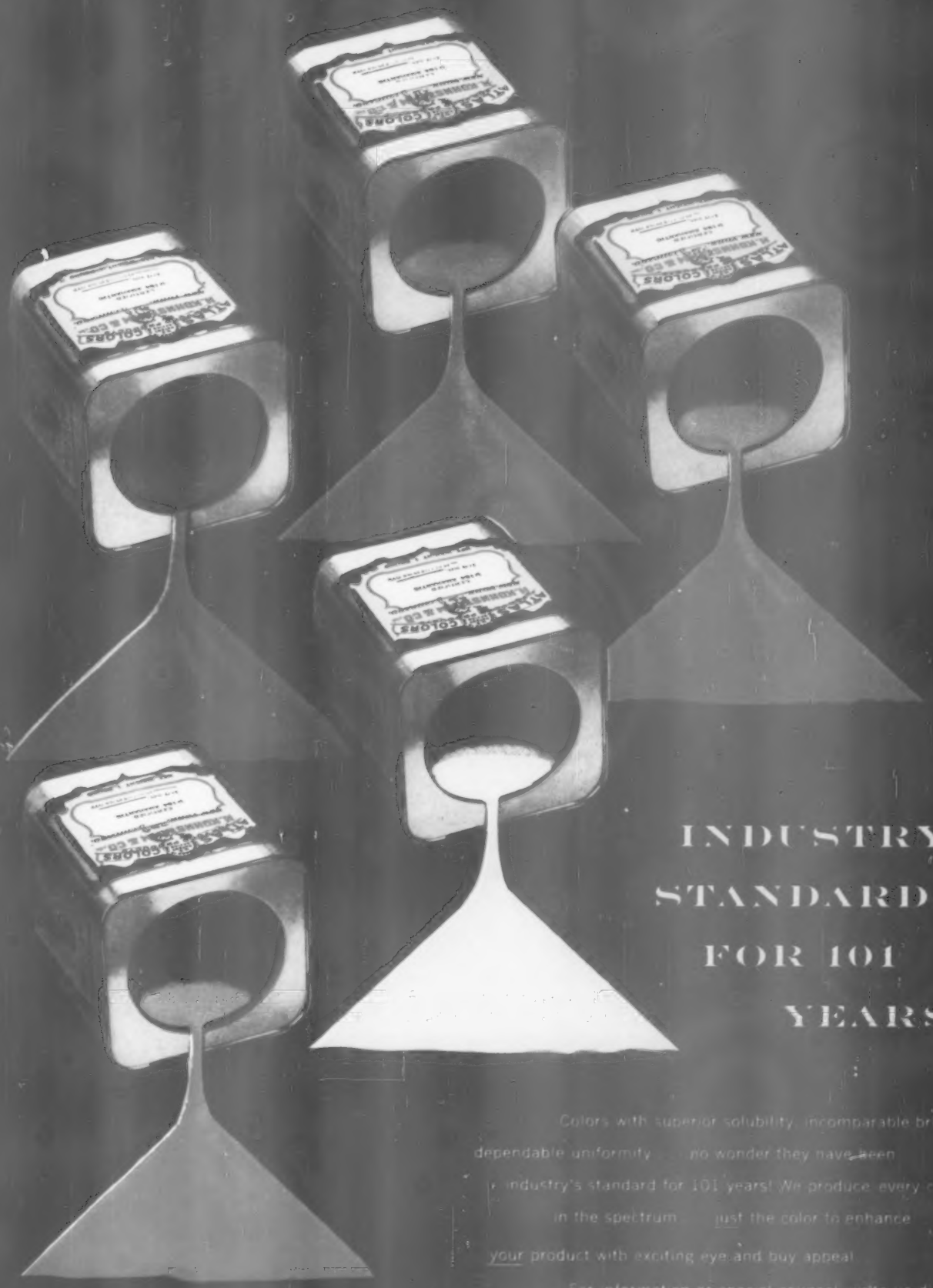
After watching the process for several minutes I happened to walk over to the gas cylinder to see whether they were using nitrogen or carbon dioxide. What I found was that the valve on the cylinders had not been opened that day and the girl who was supposed to be putting the gas in was merely doing nothing but sticking the tube into the bottom of the container and pulling it out again.

Dehydrated vegetables deteriorate on standing and it was too much to expect these vegetables to retain their flavor when stored in beaches with the temperature over 100° F. during the day.

One dehydrator of eggs tells the following story on himself. He entered the dining car on a trip East with one of his customers one morning and sat at the table with two sailors who were wolfing down ham and eggs. When they were asked about the food, the sailors said it was fine, that they had been used to eating these —— dehydrated eggs. When asked what the trouble with them was, they said that you got a mouthful of the eggs and when you started chewing you found you were chewing a mouthful of powdered stuff with no taste and like a gumdrop in your mouth. This drier got busy, hired a cook and found out the best way to prepare scrambled eggs from the dried egg. One or two eating places in Chicago specializing in breakfasts started serving a special on scrambled eggs and soon found that their customers didn't know the difference between the fresh and dried eggs when made up into an egg dish.

My final job in the service was with W. E. O. in Brazil to find the possibility of producing concentrated orange juice in that country. I found that there was a nice little plant there put up by an American company. Their only trouble was in knowing how to run the plant. The product which they had put out was not at

(Continued on page 14)



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Awards and Honors

(Continued from page 12)

all acceptable to the foreign purchasers and was being used for making alcohol.

I also visited Paraguay and found conditions there still worse. As was usual in war days, we spent a lot of money and got nothing for it.

In closing may I again express my appreciation of this honor. I regret that the men who so ably carried on with me are not here to share it. Some of them have passed on and those who are still here are scattered far and wide.

MONSANTO PRESENTATION AWARD WON BY RICHARD H. FORSYTHE

Dr. Philip K. Bates, Chairman of the Monsanto Presentation Award Committee, has announced that the first annual Monsanto Presentation Award has been bestowed upon Richard H. Forsythe, who delivered the excellent paper entitled "Factors Affecting the Microbiological Populations of Shell Eggs" (No. 75), at the Twelfth Annual Convention in Grand Rapids. Effective organization and clarity of presentation were two of the many distinguishing features of the paper.

Dr. Forsythe, formerly a research associate in the Poultry Husbandry Department at Iowa State College, is presently affiliated with the laboratories of Armour and Company in Chicago.

On the occasion of this initial award it will be appropriate to recount some background information regarding the task of selection. The recipient was chosen by the Award Committee, consisting of Philip K. Bates, Basil Clarke, and Olin Ball, after the committee weighed the evaluation ballots prepared by fifty-four judges. Fifteen of these judges worked two or more sessions; two covered three sessions and one covered four sessions. Seventy-five ballots were submitted to the committee; each ballot carried a comparative numerical rating of all speakers in a single session. The careful weighing of the evidence involved in the selection of the first Monsanto Presentation awardee indicates that Dr. Forsythe's triumph was well merited. The Institute's congratulations to Dr. Forsythe!

TECHNICAL ASSISTANCE FISHERY DEVELOPMENT PROJECTS

Projects for fishery development are forming an important part of the Expanded Technical Assistance Program of the Food and Agriculture Organization of the United Nations. Governments of the Far East, Latin America, and the West Indies, are receiving advice on the expansion and improvement of their fishery industries, according to the FAO procedure by which an expert is attached to a Government, by request, for a stated period, and for a particular assignment, according to an August press release from FAO in Rome.

The projects under way include general appraisal surveys of fishery resources, such as is at present being carried out by an FAO fishery biologist in Ecuador. A preliminary survey of a less detailed nature is to be made in Brazil by an FAO fishery specialist in order to determine which types of technical assistance will be needed to improve fishing methods and increase domestic consumption. Two Netherlands experts have been sent to Pakistan to advise on the development of a fish harbor at Karachi, in order to relieve the congestion of the present port, and provide for a larger mechanized fishing fleet, which the Pakistan Government intends to develop. Ceylon is receiving assistance in the mechanization of its fishing fleet and gear, to increase production for local consumption.

Other specialized projects aim at spreading the Far Eastern techniques for the growing of fish in ponds to furnish a convenient source of protein. A technical assistance project of this nature has been under way in Haiti. Artificial ponds have been constructed and these have been stocked with carp from the United States, and a fast-growing fish called *Tilapia* from Jamaica. Experiments are also being carried out in the rearing of indigenous fish in the ponds. In Thailand, existing fish ponds are operated mainly by residents around Bangkok, but the Government is anxious to increase fish production for consumption among peoples living in the hinterland where animal proteins are scarce and expensive. Accordingly, the Government of Thailand has requested the services of an FAO expert to develop an extension service among inland fish farmers on freshwater fish culture methods.

Fishery educational work is also in progress. Under the sponsorship of the Government of Chile, a Fisheries Training Center will be conducted for ten weeks beginning in January 1952. The center will draw some fifty students from South American countries. They will receive intensified instruction in fishery biology, technology, economics, administration, and related subjects. Instructors will be drawn from among fishery specialists in North and South America and Europe. [From *Com. Fisheries Rev.*, **13** (9) *22* (1951) September.]

FUTURE DATES FOR FOOD TECHNOLOGISTS

Sept. 9-13	Seventh National Chemical Exposition, ACS, Coliseum, Chicago, Ill.
Sept. 14-19	One hundred and twenty-second National Meeting, American Chemical Society, Atlantic City, N. J.
Sept. 29-Oct. 1	Annual Meeting, Association of Official Agricultural Chemists, Shoreham Hotel, Washington, D. C.
Oct. 20-22	Fall Meeting, American Oil Chemists' Society, Cincinnati, Ohio
Oct. 20-22	Annual Forum, Packaging Institute, Hotel Commodore, New York, N. Y.
Nov. 17-20	American Bottlers of Carbonated Beverages, Annual Convention, Atlantic City, N. J.
Dec. 28-31	One hundred and nineteenth Meeting, American Association for the Advancement of Science, St. Louis, Mo.

1953

June	**Institute of Food Technologists, Thirteenth Annual Meeting, Boston, Mass.**

(Information concerning future dates of national and international meetings, conventions and exhibits of interest to food technologists should be sent to the editorial office.)

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Regional Section News

AUSTRALIAN SECTION

Two meetings of the Australian Section were held during May. The first was on May 13th at Melbourne University where Mr. Frank Elsworth gave an address on Post-War Japan. Mr. Elsworth discussed the agricultural and food industries of Japan and illustrated his talk with color photographs which he took on his recent trip. The second meeting on May 27th took place at Science House, Sydney, where members listened to Mr. W. Hopkins, Production Manager for H. Jones and Co., Ltd., talk on "Materials Handling in the Food Industry." The subject matter of the address included a discussion of conveyor belts and their construction, roller conveyors, can handling equipment, fork-lift trucks and their operation, monorail conveyors and various types of pumps.

The Executive of the Australian Section has been considering for some time the division of the Section into two or more separate Sections, and a preliminary approach has been made to the Institute on this matter through our Councilor at the recent Grand Rapids meetings. The huge geographic area of Australia makes it difficult to organize meetings and functions on a National basis, and it is felt that the interests of the Institute will be better served by encouraging the formation of separate Sections in each of the Australian States.

The second annual convention of the Australian Regional Section was held at Hawkesbury Agricultural College, Richmond, N.S.W., July 2-4, 1952. The agricultural adviser to the United Kingdom High Commissioner in Australia, Mr. C. W. Strutt, delivered the dinner meeting address, his topic being "Development of the Modern Dairy Industry in Britain." Professor J. P. Baxter, School of Chemical Engineering, N.S.W. University of Technology, spoke at an earlier session on food technology as a professional field for the chemical engineer. Other papers presented during the meetings include two papers relating to vegetable production, "Maturity Prediction for Peas" by R. S. Mitchell and L. J. Lynch (Division of Food Preservation, C.S.I.R.O.), and "Vegetable Production for Commercial Canning" by R. P. Jones (Gordon Edgell and Sons, Ltd.). "Tasmanian Berry Fruit for Processing" was the title of the paper presented by D. Martin (C.S.I.R.O. Regional Laboratory, Hobart). Fats and oils were discussed by Dr. F. H. Reuter (School of Applied Chemistry, N.S.W. University of Technology), the subject of his paper being the effect of regional factors on the composition of vegetable fats, by G. F. Greathead (Edible Oils Industry Pty., Ltd., Sydney), who spoke on the plasticity of fats, and by W. J. Coleman (Marickville Margarine Pty., Ltd., Sydney), who reported on edible oil and fat resources in Australia. An excursion to the Blue Mountains and the Warragamba Dam site featured the non-technical part of the program.

* * *

The proposal to divide the Australian Section of the Institute of Food Technologists into two subsections has been submitted to a mail vote and pending the outcome, the present officers of the Australian IFT will continue to serve.

CHICAGO SECTION

Meetings of the Chicago Section will be held on the second Monday of each month, November through May of the 1952-53 season.

The October 11 meeting of the Chicago Section will be held at Champaign, Illinois, on the University of Illinois campus. The group will be the guests of the University of Illinois student chapter which is sponsored by Dr. Louis B. Howard, University of Illinois College of Agriculture.

Dr. Harry E. Goresline, formerly head of the Research Division, Poultry Branch, Production and Marketing Administration, USDA, Washington, D. C., is a new member of the Chicago Section. His new post, chief of the QM. Food and Container Institute's Stability Division, involves supervision of that organization's extensive program relative to chemical, histological, and microbiological causes of deterioration in processed ration foods subjected to storage under uncontrolled conditions. Dr. Goresline succeeds Dr. Carl S. Pederson who has returned to his previous position with the New York State Experiment Station at Geneva.

* * *

It is with deep sorrow that the accidental death of a long-time member of the Chicago Section, J. B. Rolle, Head of Vegetable Juices, Inc., must be recorded in this issue. Death occurred on July 13, 1952, as a result of an automobile accident sustained near Lakeside, Michigan. The Chicago Section together with the entire Institute has suffered the loss of a member who gave thought and energy to progressing the work of the organization locally and nationally.

PERSONNEL

ARTHUR E. STEVENSON, assistant to the general manager of the Research Division, Continental Can Company, retired on July 1, 1952, after 26 years with that company. One of today's outstanding food technologists, he is an authority on the chemical relationship of food to metal surfaces and his studies on discoloration in canned beets, on preserving color in canned peas, and many others have led to wide practical application. Mr. Stevenson's research pursuits have taken him into many other areas in addition to those mentioned, the treatment of tin surfaces for greater resistance against stain, the inhibition of corrosion in metal containers, and studies in the conservation of tin being the ones that immediately come to mind. Among many honors that have come to him is the Nicolas Appert Award, bestowed by the Chicago Section of the Institute in 1951. Mr. Stevenson will retire to his home town, Lawrence, Kansas, which is also the site of his alma mater, the University of Kansas.

From DR. HOWARD O. TRIEBOLD of the Pennsylvania State College Department of Agricultural and Biological Chemistry comes the announcement that BERNARD ACKERMAN, ROBERT Q. THOMPSON, and ROBERT L. COWAN were recently graduated from that institution with the degrees of Ph.D. Dr. Ackerman has joined the research staff of Swift and Company, Chicago; Dr. Thompson the research department of Parke, Davis and Company, Detroit; and Dr. Cowan has accepted a post on the faculty of the Animal Nutrition Department, Pennsylvania State College.

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Selected Abstracts*

ANALYTICAL METHODS

A technic for the identification and separation of enzymes by paper chromatography.

GIRI, K. V., PRASAD, A. L. N., GOWRIDEVI, S., AND SRIRAM, J. *Biochem. J., 51,* 123-8 (1952).

A technic for the identification and separation of enzymes by paper chromatography is described. The application of this technic to the study of the movement of amylases, phosphorylases and phosphatases on paper has been examined and R_f values tabulated. Aqueous acetone, aqueous ethanol and sodium chloride solutions have proved useful as solvents for the study of the movement of the enzymes on paper. Some examples of the separation of enzymes by means of this technic are given. The usefulness and potentialities of this technic in the study of the chromatographic behavior of enzymes are discussed.

Estimation of 2- and 3-tert-butyl-4-hydroxyanisole isomers.

MAHON, J. H., AND CHAPMAN, R. A. *Anal. Chem., 24,* 534-6 (1952).

A method has been developed which is applicable to antioxidant preparations containing butylated hydroxyanisole alone and in the presence of propyl gallate. The 3-*tert*-butyl-4-hydroxyanisole content of three common butylated hydroxyanisole preparations was found to range from 63 to 95%. The 95% confidence limits for the determinations of the percentage of the isomers were ± 3.0% units and less than ± 1.0% for the determination of total butylated hydroxyanisole. This procedure may be used to establish the potential effectiveness of common butylated hydroxyanisole products and to determine total butylated hydroxyanisole in lard and shortening.

BIOLOGICAL SCIENCES

BIOCHEMISTRY

Mechanism of enzyme action.

LEACH, S. J., AND LINDLEY, H. *Nature, 169,* 360-1 (1952).

The ratio of aspartic acid and asparagine to glutamic acid and glutamine, of decarboxylic acids and amides to serine and threonine, and of dicarboxylic acids and amides and tyrosine to hydroxy acids and histidine, and tryptophan and cysteine were found to be within certain limits for enzymes, but outside these limits for the non-enzymic proteins studied. This suggested that enzymic properties depend on the order and arrangement of the amino-acid side-chains of the enzyme mol. and the degree and mode of hydrogen bonding.

Dextran-splitting anaerobic bacteria from the human intestine.

HEHRE, E. J., AND SERY, T. W. *J. Bact., 63,* 424-5 (1952).

Dextran of bacterial origin is being used increasingly as a plasma substitute in man. An enzyme system able to cause dextran degradation has been found to be produced by certain gram negative intestinal bacteria.

The action of fish tissue on thiamin. I. The isolation of icthiamin.

BARNHURST, J. D., AND HENNESSY, D. J. *J. Am. Chem. Soc., 74,* 353-5 (1952).

Thiamin is inactivated by a constituent of clam tissue. The principal pyrimidine derivative formed thereby is icthiamin of empirical formula $C_8H_{14}N_4O_2S$. A method of isolation of icthiamin as its dihydrobromide is presented, utilizing ion exchange, precipitated with silico-tungstic acid and precipitated with Ag+. An assay method is presented for the estimation of icthiamin during the isolation.

Symposium on intravenous lipid emulsions.

Trans., N. Y. Acad. Sci., 14, 77-85 (1951).

Intravenous lipid emulsions, E. D. Goldsmith; Clinical studies on hepatic function following administration of intravenous fat emulsions, W. Waddell *et al;* The administration of fat emulsions in man, B. G. P. Shafiroff; The localization of particulate fat in injured blood vessels, W. B. McAllister and L. L. Waters; Problems in the provision of calories parenterally, S. C. Werner.

A-bomb radiation releases dangerous protein into blood.

Science News Letter, 61, 162 (1952).

Recent atomic bomb tests have added further proof to a discovery that ferritin, an iron-bearing protein, associated with the iron transport system in the blood, must be dealt with in the treatment of radiation injury. Appreciable amounts of ferritin liberated into the blood from the liver by radiation causes a paralysis of the peripheral vascular blood circulation and upsets the normal balance in the blood stream. Identical results were obtained with rats exposed to x-rays and dogs exposed to radiation in atomic bomb explosions.

The reaction between proteins and reducing sugars in the "dry" state. Relative reactivity of the α- and ε-amino groups of insulin.

SCHWARTZ, H. M., AND LEA, C. H. *Biochem. J., 50,* 713-16 (1952).

The reaction at 37° between insulin and glucose freeze-dried together from solution at pH 7 has been investigated. The rate of reaction has been shown to increase with increasing activity of water to a maximum at a water content in equilibrium with a relative humidity of approximately 70%, and thereafter to decrease again with further increase in water content. The reactivities towards glucose of the α-amino groups attached to the terminal phenylalanyl and glycyl residues, and of the ε-amino groups attached to the lysyl residues of insulin have been determined by the fluorodinitrobenzene method. After 4 days at 65% relative humidity, 70% of the phenylalanyl amino groups, 37% of the glycyl amino groups and only 21% of the lysyl amino groups had reacted. After 16 days the corresponding figures were 80, 66 and 55%.

Characterization of some sugars of interest to biochemistry.

MANDI, I., AND NEUBERG, C. *Archi. Biochem. Biophysics, 35,* 326-34 (1952).

Up till now readily formed derivatives from which the free sugars could be easily recovered were lacking in the case of several carbohydrates of biochemical interest. 2,5-Dichlorophenylhydrazones satisfy these requirements. Their preparation and characteristics are described. Asymmetrical diphenylhydrazine is preferable as a reagent for the separation of arabinose and ribose.

Rapid infusions of invert sugar.

WEINSTEIN, J. J., AND LANE, G. F. *Med. Ann. District of Columbia, 20,* 186-92 (1952); *Am. J. Digestive Diseases, 19,* 57 (1952).

Report of single infusion of 50 grams of invert sugar-equimolar in glucose and fructose- in 34 minutes with 99.2% assimilation. Fructose is a better glycogen former than glucose even in the absence of insulin. Invert sugar is more readily utilized than glucose in equal amounts. Twice as much invert sugar than glucose (gms./kilo body wt.) may be given intravenously with almost 100% utilization.

An investigation of the chronic toxicity and acceptability of Castrix.

CRAMPTON, J. M., AND VOSS, E. *J. Am. Pharm. Assoc., 41,* 135-8 (1952).

Investigations have been made of the effects of prolonged exposure of the albino rat to Castrix (2-chloro-4-dimethylamino-6-methyl-pyrimidine), and the acceptability of Castrix when administered to rats in their food and water. Results indicate a low degree of chronic toxicity. Reproductive ability is not reduced following administration of Castrix. A low degree of acceptability was demonstrated for Castrix-poisoned food and water.

(Continued on page 20)

* These Selected Abstracts are made available to FOOD TECHNOLOGY through the cooperation of Associate Editor H. A. Campbell and the General Foods Corporation of New York, N. Y. The abbreviations found in these abstracts are similar to those used by Chemical Abstracts.

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no distortion found in any of the products Study carefully t... as outlined in the ingredients wer... st important Felton contribu... by doing Never before ... in accom- all phases ... matter are no distortion ... the products ...outlined in the ...e most important ...paign by doing ...ed in accom- ... matter are ... products ... in the ...tant ...ing ...com- ...e ...ts ...he ...con- ...are ... the products ...tlined in the ...ost important ...paign by doing ...ded in accom- ...an important matter are

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Abstracts

(Continued from page 18)

Some problems in assessing the toxicity of the organo-phosphorus insecticides towards mammals.

ALDRIDGE, W. N., AND BARNES, J. M. *Nature, 169,* 345-7 (1952).

Those discussed are purity of material, conversion into a toxic agent *in vivo*, susceptibility of male and female rats, and route of injection.

Lead poisoning in young children.

WILLIAM, H., KAPLAN, E., COUCHMAN, C. E., AND SAYERS, R. R. *Public Health Repts., 67,* 230-49 (1952).

Lead poisoning is cumulative. Early symptoms may be only irritability, fretfulness, or disturbed gastrointestinal function characterized by lack of appetite, constipation, vomiting, or cramps. A secondary anemia with resulting pallor is often present. More severe intoxication results in lead encephalitis due to increased intracranial pressure because of cerebral edema. The acute stages of the disease are manifested in changes in mental state, ataxia, persistent vomiting, muscle weakness or paralysis, delirium, stupor, coma, convulsions, and, not infrequently, death. Lead poisoning in children differs considerably from the disease in adults. Central nervous system involvement or encephalopathy, is common in children, whereas peripheral neuritis lead line on the gums, and colic are usually absent. The prognosis in lead encephalitis in children is poor; there is a mortality rate, and the incidence of severe, lifelong, residual nervous system injury. The mental development of even the less severe cases may be seriously impaired.

NUTRITION

Principles of emergency feeding for a large metropolitan area in catastrophe.

GOODHART, R. S., AND JOLLIFFE, N. *Am. J. Pub. Health, 42,* 373-8 (1952).

Menus for emergency periods (up to one week) for the following groups are discussed: 1. Normal uninjured persons. 2. Essential workers. 3. Vulnerable groups (children under four, pregnant and lactating women). 4. Sick persons (minor injuries). 5. Severely injured and burned persons. Menus are worked out to meet minimum requirements of energy, protein, thiamin and water.

Animal versus vegetable foods in nutrition.

Nutritional Revs., 10, 87-88 (1952).

The main vegetable crops eaten by human beings supply a superabundance of energy, but their nutritive value for humans is limited by their shortage of vitamins and amino acids. The animal proteins supply a superabundance of vitamins and amino acids per unit of energy. It is the complementary, rather than the comparative value of foods that is important. A survey of recent work involving the supplementary action of proteins on each other in supplying adequate quantities of essential amino acids and promoting growth is presented.

Protein requirements of old age.

ALBANESE, A. A., HIGGONS, R. A., VESTAL, B., STEPHANSON, L., AND MALSCH, M. *Geriatrics, 7,* 109-16 (1952).

The dietary needs of normal male infants, young male and female adults and aging women have been compared in terms of blood protein levels, excretion of products of protein metabolism, and calorimetric data. From these determinations it appears that the caloric and protein needs of this age group are 20 to 30% lower than those recommended for sedentary female adults by the Food and Nutrition Board of the National Research Council. This low plane of nutrition which may be a physiological function of age, supports normal blood hemoglobin and total plasma protein levels, as well as good health in women ranging in age from 66 to 94 years. The implications of these findings is discussed in detail.

Degenerative joint disease in mice fed high protein diets.

SILBERBERG, M., AND SILBERBERG, R. *J. Gerontology, 7,* 24-31 (1952).

In growing mice of strain C_{57} black fed diets containing 53% casein or 46% fish-protein from the time of weaning, skeletal development was accelerated as compared with conditions seen in animals of the same strain fed a stock diet containing 26% protein. Males responded more readily than females to the change in the dietary regimen. Articular aging was retarded and the onset of degenerative joint disease was delayed in the mice fed the protein-enriched diets. These results are in marked contrast to those obtained by feeding a fat enriched diet, which caused an acceleration of skeletal aging and an increased incidence of degenerative joint disease.

Nonessential amino acids and nitrogen utilization.

Nutrition Revs., 10, 10-11 (1952).

To promote efficient utilization of the nitrogen of an amino acid mixture at least 20% of the nitrogen should be in a form other than that of the essential amino acids. Of these supplements, ammonium citrate and glutamic acid promoted the best growth in repleted rats. Good results were obtained with supplements of non-essential amino acids or with urea.

The effects of heat on the nutritive value of protein hydrolysates with dextrose.

OVERBY, L. R., AND FROST, D. V. *J. Nutrition, 46,* 539-49 (1952).

The effects of heat on the nutritive value of fibrin hydrolysate and dextrose solutions were studied. A significant decrease in rat repletion response was noted when: (1) the amino nitrogen had shown about 6 to 8% decrease; (2) fluorescence had decreased to a low value following an early maximum; (3) color had developed to a marked degree following an initial induction period. Microbiological assay of the heat-darkened hydrolysate with dextrose indicated progressive loss of many of the individual essential amino acids. The greatest individual loss was in tryptophan. All amino acids except tryptophan were largely recoverable upon complete acid hydrolysis. Prolonged heating produced changes in the hydrolysate-glucose solutions which were not overcome by replacement of tryptophan alone. The amino acid composition of heat-damaged hydrolysate-glucose solutions determined by microbiological assay does not give a true index of nutritive value.

Dietary cholesterol and atherosclerosis.

TUTTLE, E. *Geriatrics, 7,* 37-41 (1952).

Insofar as hypercholesterolemia is incident to, or causative of, atherosclerosis accompanying coronary sclerosis, its control requires: Some cholesterol synthesized in the body. The deprivation of certain fats and other high cholesterol foods is required in a therapeutic diet to lower the blood cholesterol. Exclusion of animal sources of cholesterol and of non-physiological fats, like hydrogenated fats, diminish the blood cholesterol levels. Drugs like thyroid administered to accelerate aerobic, and particularly anaerobic oxidation, are usually required. Proper vitamin B formulations are necessary to stimulate enzymatic activity. An outside source of unsaturated fat acids especially those derived from sunflower seed, lecithin or even sunflower seed oil, relieve the liver of desaturation burden and help in the utilization of free cholesterol.

Dental caries in the cotton rat.

CONSTANT, M. A., PHILLIPS, P. H., AND ELVEHJEM, C. A. *J. Nutrition, 46,* 271-80 (1952).

The effect of whole grain versus processed cereals and alkali-ash versus acid-ash foods on the experimental production of dental caries in the cotton rat has been studied. When fed under similar conditions, the whole grain cereals, corn, wheat and oats, were found to be less cariogenic in each case than their processed products—corn flakes, wheat flakes and oatmeal, respectively. A significant difference was not found between the cariogenicity of alkali-ash and that of acid-ash foods under the experimental conditions used.

(Continued on page 32 following technical papers)

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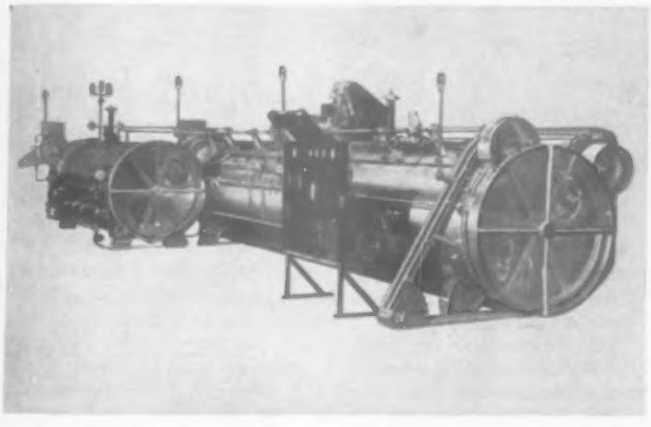

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Notes and Letters

Massachusetts Graduates in Food Technology

To the Editor of FOOD TECHNOLOGY:

There has been considerable interest in the interrelationship between university curricula and the field of food technology as evidenced by the formation of an IFT Committee and a Symposium on Education and Curricula during the Twelfth Annual Meeting at Grand Rapids, Mich. Some data were collected for presentation at the University of Massachusetts luncheon which proved so enlightening that it was felt that they would be of interest to the general membership of the IFT.

About two weeks before the meeting 198 questionnaires were dispatched to Massachusetts graduates with the aim of determining their disposition in the field of food technology. Replies were received from 84, only 2 of which indicated that they had left the field. The types of activities of the 84 graduates were as follows:

Research	60%
Production	26%
Government	22%
Teaching	22%
Quality Control	8%
Technical Sales	6%

The sum is greater than 100% since many reports indicated 2 or more classes of activities. Of the fields covered, the following tabulations were made:

Canning	51%
Freezing	40%
Special & Misc.	32%
Meats	21%
Fish	17%
Dairy	8%
Vitamins	7%
Packaging	5%
Animal Nutrition	5%
Pharmaceuticals	4%

Those replying had authored 656 articles.

University of Massachusetts graduates now working in the food field are carrying out their work in 30 different states. Most are in Massachusetts, followed by New York, New Jersey, California, Florida, Connecticut, and Washington, in that order. They are also carrying out their work in 17 foreign countries with the most being in India, followed closely by Egypt, Chile, Mexico, the Philippines, Norway, and Turkey.

The first B.S. was awarded in 1919 and since then there have been 135 B.S. degrees granted. The first M.S., which was initiated with the coming of Fellers, was awarded in 1932 and there have been 112 such degrees awarded. The first Ph.D. was awarded in 1934 and there have been 63 doctorates granted. This compares with the figures read at the above-mentioned symposium of 709 B.S., 251 M.S., and 98 Ph.D. degrees granted since 1944 in all organized food technology programs in the United States.

ROY E. MORSE
Kingan and Co.
Indianapolis, Indiana

June 24, 1952

Short Term Prediction of Maturity and Yield of Canning Peas

In 1944 work was begun in this Division on the general problem of improvement in quality of canned green peas on the basis of the critical nature of the picking maturity of the raw product. At the outset a portable instrument known as the Maturometer [a] *(6)* was designed and constructed for use in field investigations. This instrument, which measures the pressure in pounds required to puncture a sample of 143 peas by an equal number of steel pins, gives readings which correlate highly ($r = +0.981$) with Alcohol Insoluble Solids (AIS) values of canned samples, the relationship being expressed by the regression equation:

$$\text{Maturometer lb.} = 33\ \text{AIS} - 153$$

A number of instruments have been developed in U. S. A. for the objective measurement of maturity in peas. The Tenderometer was designed by Martin in 1937 *(7)*, and has been in general use in the Canning industry since that time. Christel *(1)* produced the Texturemeter, and more recently some prominence has been given to the Shear-Press *(4)*, a multi-purpose device for the evaluation of quality in a variety of foods.

Kramer, Scott, Guyer and Ide *(5)* state that the Tenderometer gave a high degree of correlation with AIS both raw and canned ($r = 0.95$ and $r = 0.97$), while the Texturemeter showed a considerably greater degree of variability. The authors have not had the opportunity to test the performances of the Texturemeter and the Shear-Press, but comparisons of Tenderometer and Maturometer in relation to AIS levels were made concurrently throughout the course of the experimental work reported herein. Results indicated that Maturometer readings were linear with AIS, irrespective of size grade. There was a tendency to non-linearity in the performance of the Tenderometer, the readings for small peas of low AIS value being in some instances higher than the corresponding intermediate size peas of greater AIS. It will be apparent from the later discussion of crop prediction that this irregularity in Tenderometer performance could lead to error in the assessment of the maturity of a crop, when the ungraded sample contains a high proportion of young peas. The smaller sample size required for Maturometer determination gives the practical advantage of smaller areas for crop sampling and a correspondingly smaller degree of variability in field tests. Furthermore, the Maturometer is portable and independent of a source of motive power. Thus the Maturometer is particularly suitable for crop prediction work.

The AIS value, to which reference has already been made, was introduced by Kertesz *(2, 3)*, who derived a formula for the

(Continued on page 28)

[a] The Maturometer is manufactured in Australia by E. F. Edwards and Associates, 44 Bridge Road, Sydney, at an approximate price of $450.

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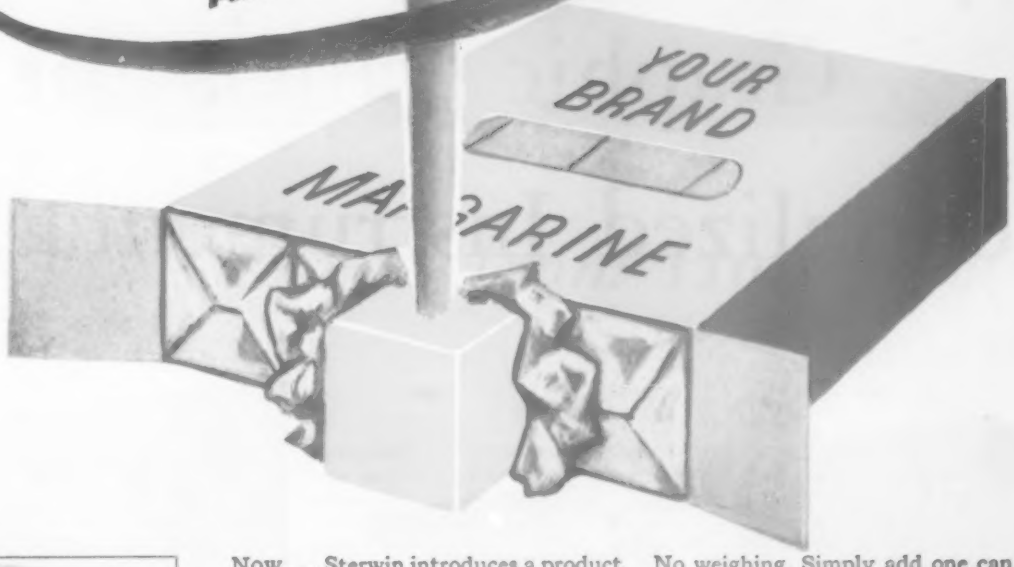

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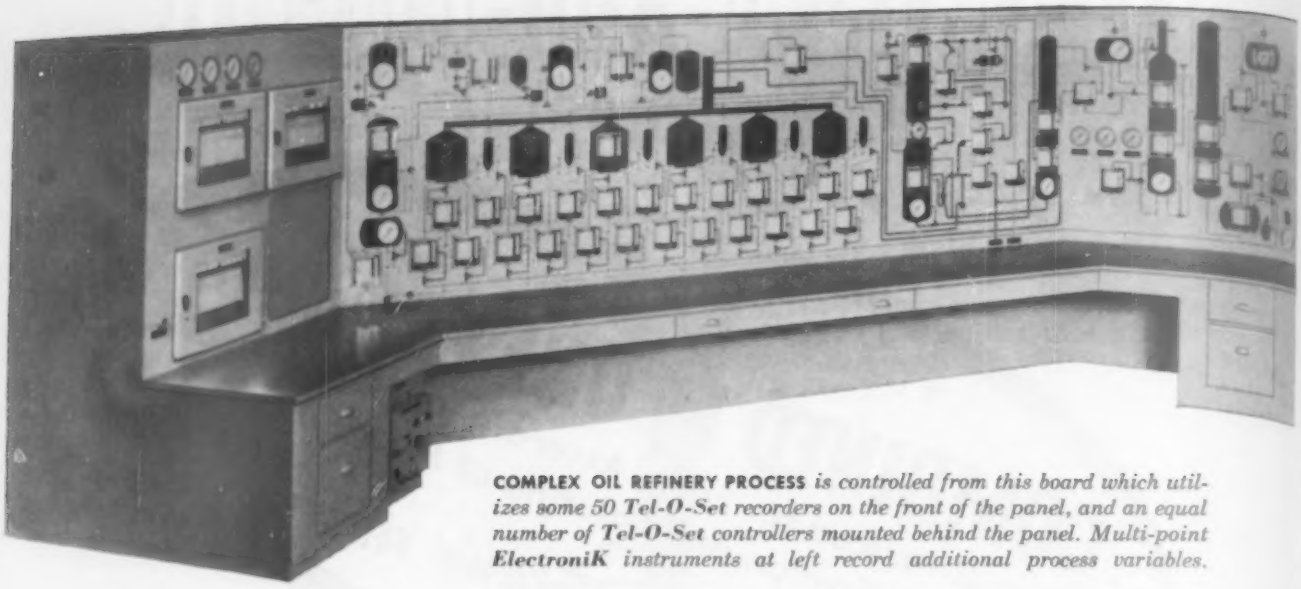

COMPLEX OIL REFINERY PROCESS *is controlled from this board which utilizes some 50* ***Tel-O-Set*** *recorders on the front of the panel, and an equal number of* ***Tel-O-Set*** *controllers mounted behind the panel. Multi-point* ***ElectroniK*** *instruments at left record additional process variables.*

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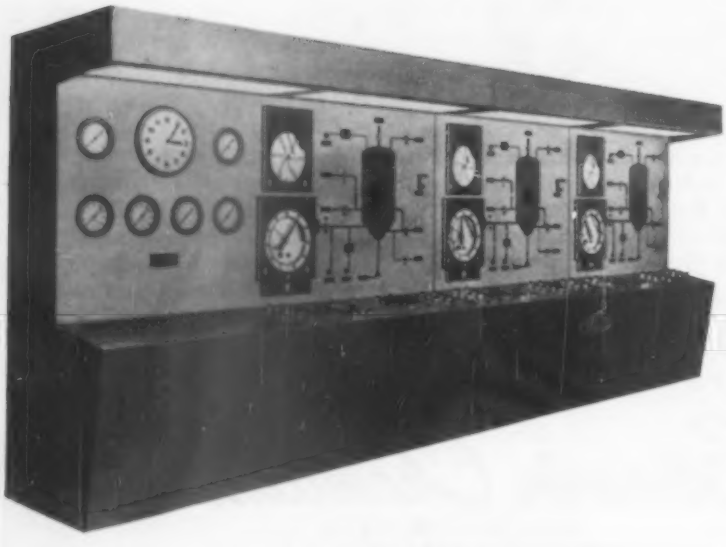

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Notes and Letters

(Continued from page 24)

conversion of AIS values to organoleptic ratings. Since 1935, the use of AIS as a measure of maturity has been generally accepted, and has proved to be valuable for the calibration of various quality measuring instruments.

The point in time of optimal harvest maturity can be defined as the date on which the greatest yield of highest quality canning peas in a crop is obtained. The range of 11 to 16% AIS was found from taste tests to define the upper and lower limits for best quality. The immediate problem consisted in finding a means of determining the maturity of a growing crop in the preharvest stages, and in particular, of recognizing optimal maturity in accordance with the above definition.

It was found that Maturometer readings of each size grade from a single crop agreed well in replicate determinations. Further, the Maturometer value of a mixture of sizes was in agreement with the mean for the individual size grades weighted in accordance with the proportions by number in which they occurred in the mixed sample. This suggested that measurements on ungraded samples from a growing crop should indicate the maturity of the crop as a whole. Daily measurements were made on a large number of growing crops. The results, when plotted, gave a curve which did not deviate greatly from a straight line. The instrument value of the ungraded sample was termed the Maturometer Index (M.I.) At the same time the Maturometer readings of each size grade were separately determined, together with the proportions by weight and by number in which they were found to occur.

A typical graph of the yield data obtained on a crop in the final maturation period is shown in Figure 1.

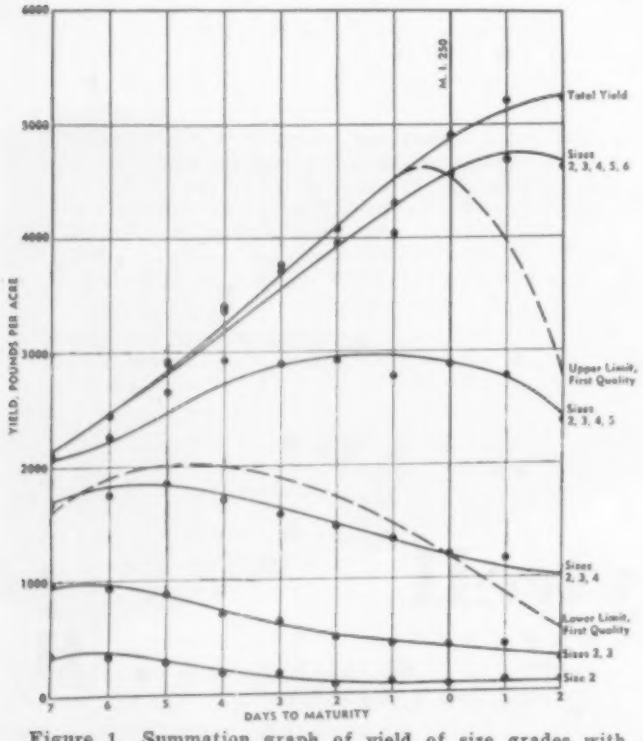

Figure 1. Summation graph of yield of size grades with time, Tasmanian pea maturation trial, 1952.

From the superimposed upper and lower quality limits of 11 to 16% AIS, it will be seen that the crop approximates the theoretical definition of optimal harvest maturity when the M. I. has a value of 250. Total yield and quantity of peas of best quality increase regularly to M. I. 250, but it is to be noted that while total yield continues to increase thereafter, a marked decrease is found to occur in the yield of peas of optimal quality. The M. I. 250 value therefore represents the best compromise between yield and quality, and the point of convergence of grower's and canner's interests.

The mere recognition in the field of the correct date of harvest is not sufficient in itself, but must be predicted in advance to enable field and factory staffs to make the necessary arrangements for orderly harvest. Short term prediction was based upon the linearity of the M. I. curve, and consisted in the harvesting of a composite sample of vines from selected portions of the field, commencing about 7 days prior to the harvest date as judged by inspection of the crop. The vines were passed through a commercial viner and the peas so obtained were recovered from a commercial clipper cleaner in which they were freed of foreign matter, broken peas, and peas smaller than canning size. The sample was well mixed and the mean of four determinations was recorded as the M. I. This value when subtracted from 250 and the remainder divided by 20 (20 lb. per day being the approximate increase in M. I.) gave the number of days to harvest. The sampling error was reduced by using the mean of the M. I. values for three successive days making the necessary adjustment in time when calculating days to maturity thus:

If R_1 is the M. I. at time — 2 days,
R_2 is the M. I. at time — 1 day,
and R_3 is the M. I. at time 0 days,
the mean is $\frac{1}{3}(R_1 + R_2 + R_3)$ at time — 1 day.

For example, if the mean value of M. I. for three successive days is 150, the crop will mature four days thereafter. The use of means for a number of days, in preference to single day readings, in effect provides replication of the measurements. The rate of maturation, however, is affected by weather conditions, and predictions calculated from means of four or more days were unduly influenced by past weather. Our data indicate that the three day mean is the best compromise between the need for replication and the need for sensitivity to current weather.

Short term predictions were made on a large number of crops under a wide range of weather conditions including prolonged drought. Most of the observations were made on peas of Canners Perfection variety, but two varieties of wide maturity range with consequent irregular development were included, namely, Greenfeast and Emperor. In nearly every instance reliable predictions were given five days in advance, but final predictions were made two days prior to harvest with accuracy, despite gross changes in temperature and relative humidity during that period.

It is not necessary for maturity prediction to measure the area of land occupied by the sample vines. However, for the prediction of total yield and weight of vines to be harvested, it is necessary to collect samples from accurately measured areas. What we have termed "fixed area sampling" was carried out on a number of crops. This involves gathering the vines from four areas each exactly 1/1000 acre, and determining the total weight of vines before vining, the total yield of peas and the Maturometer Index. From daily fixed area samples

(Continued on page 30)

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Notes and Letters

(Continued from page 30)

on a crop, the optimal harvest date, the total yield, and the vine weight were predicted from linear regression equations against time. The data obtained indicate that this technique will give reliable predictions of total yield and vine weight.

This work forms part of the research program of this Division. Further details of these investigations will be published in full elsewhere.

L. J. Lynch,
R. S. Mitchell,
Division of Food Preservation and Transport,
Commonwealth Scientific and Industrial Research Organization,
Homebush, N. S. W. Australia

March 21, 1952.

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Books

Public Health Engineering, Vol. II. By Earle B. Phelps and Walter D. Tiedeman, 210 pages, John Wiley and Sons, Inc., New York, and Chapman and Hall, Ltd., London, November 1950. The price is $4.00.

The contents deal with the third major division in which the authors have subdivided man's environment: Food. Milk and Shellfish are treated exhaustively to illustrate those principles of sanitation which, applied to the production, handling, and distribution of food, have direct public health significance. Each, in its way, is characterized by special conditions and problems of major public health implications. The general principles of food handling and serving are illustrated by a detailed treatment of the sanitary practices in restaurants and soda shops.

The subject matter is presented in eight chapters. Chapter 1 discusses the relation of food to disease and classifies food-borne diseases. Milk-borne outbreaks by disease are also listed and the authors conclude that as a final safeguard pasteurization of milk is required. On the other hand, they report that shellfish as disease vectors results from insanitation and recommend closer regulation of the gathering of shellfish and patrol of unapproved waters. Chapter 2 discusses milk production, cow diseases, and the need for sanitary and quality control.

The role of pasteurization is presented in Chapter 3. Heating and cooling systems, temperature control, holding systems, and the problem of foam are discussed in detail. The use and design of various valves are covered in this section. By means of photographs and diagrams the authors have pointed out the defects of early methods of commercial pasteurization and the important engineering developments in heat exchangers to obtain more efficient heat transfer. Various temperature control mechanisms and devices are mentioned to provide protection against the possibility of inefficient pasteurization.

In Chapter 4 auxiliary equipment such as thermometers, motors and pumps to facilitate or control the pasteurization operations and certain auxiliary processes, such as clarification, homogenization, cream separation, etc., are discussed. The public health significance of adequate cleaning of milk containers is stressed and washing methods are described. Factors that need to be considered in laying out a milk plant are also discussed in the light of present milk codes. As in their treatment of important matters throughout the book the authors have included a flow diagram showing a typical layout of a small city milk plant.

Milk plant inspections and control are treated in Chapter 5. Emphasis is placed upon seeing that all milk offered for sale is safe, i.e., effectively heat-treated and not recontaminated after pasteurization. To ensure this, a system of records is advocated as an aid in plant control, especially in conjunction with laboratory tests on the finished product. A section on laboratory control outlining the important tests to be applied in milk control activities is included in this chapter.

Chapter 6 treats of shellfish production and control, taking oysters as the most important species. Bacteriological standards are given to indicate whether or not sanitary conditions for handling them have been employed.

Chapter 7 discusses the public health problem and restaurant sanitation involved in eating and drinking in public places. Matters pertaining to restaurant design, construction and maintenance, dish washing and inspection are considered in detail. The authors assert that much of the success of the health department's restaurant program depends upon the inspector's ability to sell his program and secure cooperation. The last chapter, No. 8, discusses the handling and disposal of garbage, refuse and municipal wastes, also rodent control.

The book contains much information on industrial production problems and methods for controlling the quality of milk and shellfish, particularly concerning the production of "safe" milk. The authors have made a valuable contribution in bringing up to date important engineering developments in matters of heat transfer. The reference material is well documented.

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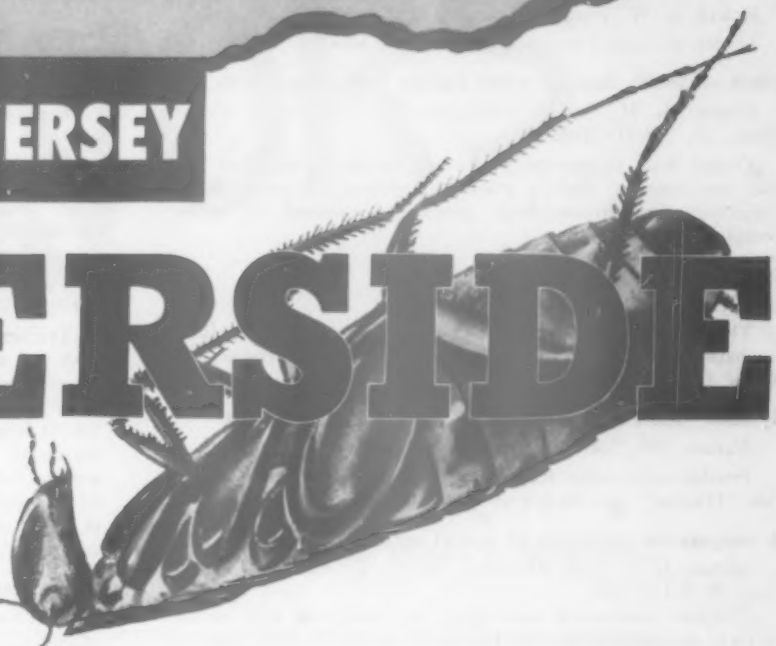

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Abstracts

(Continued from page 20 preceding technical papers)

FOOD AND FOOD TECHNOLOGY

Production and marketing innovations realized in vacuum-packed tins of cake mix.

RIMES, L. W. *Food in Canada, 12,* 22-6, March, 1952.

Merits of canned versus packaged cake mix.

Effect of potato flour on bread quality and changes with age.

HARRIS, R. H., SIBBITT, L. D., AND BANASIK, O. J. *Cereal Chem., 29,* 123-31 (1952).

Potato flour in general improved absorption and loaf volume, but impaired slightly grain and texture and color scores. Polyoxyethylene monostearate generally improved all values except absorption.

Control of cocoa shoot disease.

Chem. and Ind., 241 (1952).

The insecticide "Hanane" has been found to be successful in combating the swollen shoot disease which affects cocoa trees in the Gold Coast.

Systemic insecticides and swollen shoot disease of cocoa.

Nature, 169, 536 (1952).

Further experience has shown that a new systemic insecticide "Hanane" has dangerous toxic properties.

A comparative evaluation of several antioxidants in edible fats.

MOORE, R. N., AND BICKFORD, W. G. *J. Am. Oil Chemists Soc., 29,* 1-4 (1952).

Thirteen compounds have been intercompared with respect to their antioxidant activity in concentrations of 0.01, 0.05, and 0.10% in edible cottonseed oil, the same oil hydrogenated to shortening consistency, and in lard which is essentially free of naturally occurring antioxidants. None of the compounds exhibited significant antioxidant activity in the cottonseed oils, when used in a concentration of 0.01% but they were effective in stabilizing lard under these conditions. Propyl gallate was the most effective of the compounds tested for the vegetable fats. Examination of the data for lard indicates that the comparison of antioxidants in this and other substrates essentially devoid of natural inhibitors may yield more realistic results when compared at a peroxide level of 100 milliequivalents per kilogram of substrate.

Problems arising from the use of chemicals in foods. Antioxidants.

LEA, C. H. *Chem. and Ind.,* 179-83 (1952).

A review of antioxidants, covering their chemical nature, use, and toxicity. Antioxidants discussed include: ascorbic acid, gallic acid, and its esters, butylated hydroxyanisole, gum guaiac, NDGA, thiodipropionic acid and its dilauryl and distearyl esters, tocopherals, phospho-lipins, and tetraalkylthiuram disulphides.

Turkeys fed vitamin keep fresh longer in storage.

Science News Letter, 61, 200 (1952).

The addition of vitamin E at the rate of 0.1% of the total feed for 35 days prior to killing for storage, has increased the storage life of turkeys. The vitamin E slows down fat breakdown in the birds during cold storage. The more vitamin present in the bird, the less rancidity was found by taste panels testing birds stored as long as nine months. The vitamin was mixed with regular feed for the tests. Greater retention was found at low level feeding for 35 days than by feeding large amounts for two and a half days prior to killing. A small fraction of the total vitamin eaten was retained. Storage was greatest in the liver, with the breast, gizzard, leg and breast muscles following.

Fish preservation without heat.

NICKERSON, J. T. R., PROCTOR, B. E., AND GOLDBLITH, S. *Fish Gaz., 69,* 47, March, 1952.

Cathode rays sterilize fish without the use of heat. They also enable a study of the mechanism of decomposition by comparison of bacterial and enzymatic changes and offer a means of obtaining large quantities of sterile material that has not been denatured by heat. The limiting factor in the use of cathode rays is the penetration of the radiations. The maximum range of penetration of 3 million volt cathode rays in fish is 1.5 cm. Fourteen references.

Progress in perfumery materials.

BEDOUKIAN, P. Z. *Am. Perfumery Essent. Oil Rev., 59,* 187-90 (1952).

Annotated bibliography covering the 1951 literature on the following subjects: macrocyclic musks, ionone and irone, ambergris, vanillin, sesquiterpenes, terpenes and essential oils. 153 references.

Prevention of postharvest decay of stone fruits by volatile chemicals.

VANDEMARK, J. S., AND SHARVELLE, E. G. *Science, 115,* 149-50 (1952).

Trichloroethylene prevented all breakdown of the inoculated fruit and was effective at a concentration as low as 1: 10,000 (1 volume nonvolatilized chemicals in 10,000 volume atmosphere). No injury resulted to peaches and plums when exposed for 24 hours to concentrations of 1: 4,000 and 1: 10 000 of the chemicals. Untreated control showed complete breakdown within 5-day period. Tetrachlorethylene and 1,1,2-trichloroethane also inhibited rot completely but caused some browning of the fruit at a concentration of 1: 4,000 and less browning at 1: 10,000.

Color deterioration in strawberry preserves.

MACKINNEY, G., AND CHICHESTER, C. O. *Canner, 114,* 13, March 22, 1952.

Deterioration in the color of strawberry preserves is due to at least three causes: 1. Loss of natural red anthocyanin pigment, 2. Formation of brown pigments resulting from the so-called browning reaction, and 3. Discoloration resulting from such factors as heavy metal contamination.

Milk coagulation by rennet observed by electron-microscope.

BAUD, C. A., MORARD, J. C., AND PERNOUX, E. *C. R. Acad. Sci., Paris, 233,* 276-77 (1951); *Brit. Abstracts, B III,* 53 (1952).

Skimmed milk was diluted with aqueous $CaCl_2$, incubated at 37°, and a small amount of rennet added. Samples were taken at varying stages and examined under the electron-microscope. At first the casein particles were approximately spherical with a diameter of 90-125 mμ and showed random distribution. Later they became aligned and stuck together to form small knotted fibrils. These fibrils later began to fall into line with each other to form small bundles. In each bundle the swellings in the fibrils, corresponding to the particles forming them, were at the same level the entire length of the bundle. The final stage in coagulation occurred when the bundles became entangled together to form a three-dimensional network. This formation of fibrils from globular proteins appears to be a general phenomenon.

Factory inspection.

Food Drug Cosmetic Law Repts., March 3, 1952.

Refusal of a food processor to authorize inspection of his factory by food and drug inspectors is not a crime. Such inspections are authorized only after permission is obtained from the factory operator, and refusal to give such permission is not an offense.

The use of chemicals in food.

AYLWARD, F. *Food Manuf., 26,* 434-7 (1951).

The first part of this article discussed the background of the Delaney Report on the investigations carried out on the use of chemicals in food. This second and concluding installment presents the evidence given during these investigations.

(Continued on page 34)

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Abstracts

(Continued from page 32)

INDUSTRIAL CHEMISTRY

The care of industrial floors.

SMALLEY D. E. *Modern Sanit., 4,* 28-31, March, 1952.

Care of concrete, wooden block, terrazzo, rubber, asphalt, linoleum, and marble floors is discussed.

The testing and use of fungicided paints in food processing plants.

RICHARDSON, J. H., AND DEL GIUDICE, V. J. *Modern Sanit., 4,* 32-7, March, 1952.

Details of the method used for testing fungicided paints are described. Results of tests using various fungicides are given.

Use of substitutes for carbon tet suggested.

Chem. Eng. News, 30, 1536 (1952).

Less toxic solvents than carbon tetrachloride should be substituted where possible. The American Conference of Governmental Hygienists has recommended that the limit for CCl_4 exposure to the human should be 50 parts per million per eight-hour day, but the limit should and will be reduced to 25 parts per million. Moreover, when exposed to heat it may break down to phosgene and hydrochloric acid.

ORGANIC CHEMISTRY

Thermal decarboxylation of uronic acids.

PERLIN, A. S. *Canadian J. Chem., 30,* 278-90 (1952).

A novel decarboxylation of uronic acids by merely heating the material without the use of a solvent or added catalyst is described. At approximately 255° C. decarboxylation for uronic and polyuronic acids and salts within 15 minutes reaction time is nearly quantitative. Vigorous dehydration occurs simultaneously, the residue corresponding basically to a 5-carbon skeleton that contains 1.5 atoms of oxygen. Other products of the reaction are minor and include carbon monoxide, and traces of acid and oils. Sugar acids, such as gluconic and ascorbic, are not as extensively decarboxylated. The reaction is employed for analysis of several nitrogen dioxide oxidized celluloses and starches and the results are in good agreement with those given by titration and the 12% hydrochloric acid method.

PACKAGING

The prevention of corrosion in packaging. I. The use of sodium benzoate as a corrosion-inhibitor in wrappings.

STROUD, E. G., AND VERNON, W. H. J. *J. Applied Chem., 2,* 166-72 (1952).

Sodium benzoates and other soluble benzoates can be used for the production of corrosion-inhibitive wraps by impregnation in materials such as paper, strawboard, regenerated-cellulose films and waxed papers. Provided the chloride content of the wrap is sufficiently low before impregnation, complete protection is effected for steel under adverse conditions of storage or transport. The corrosion of common non-ferrous metals is in no case increased; in some cases it is substantially reduced or (e.g. solder and soldered joints) suppressed. For the protection of cast-iron surfaces it is necessary to introduce a nitrite (e.g. sodium nitrite) into the wrap; the aggressiveness of nitrite towards solder is then prevented by the joint presence of sodium benzoate, in appropriate ratio. Sodium salts of other organic acids show promise as corrosion-inhibitors in packaging materials.

The prevention of corrosion in packaging. III. Vapour-phase inhibitors.

STROUD, E. G., AND VERNON, W. H. J. *J. Applied Chem., 2,* 178-84 (1952).

(Continued on page 37)

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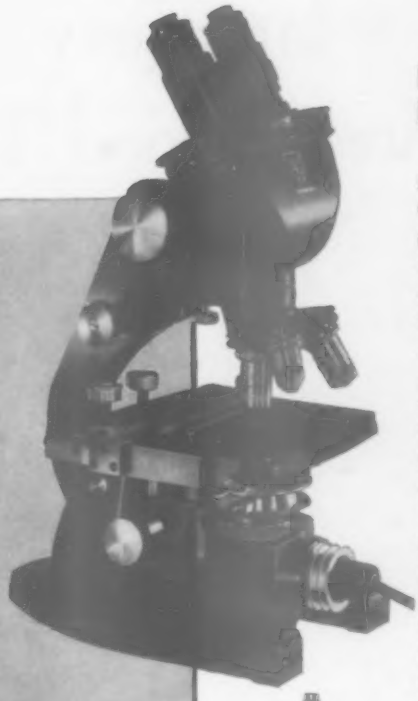

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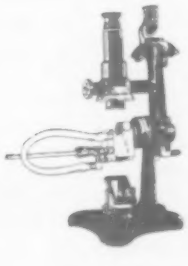

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Abstracts

(Continued from page 34)

Of many compounds examined in vapor form in moisture-laden air, a number will, in varying degrees, confer protection upon ferrous and some non-ferrous metals when contained in the same enclosed space. Certain esters (e.g. n- and isopropyl benzoates, n-butyl benzoates and methyl cinnamate) afford good protection to steel. Complete inhibition of the corrosion of steel and cast iron may be effected in moist air, even when heavily contaminated with sulphur dioxide, by certain amine carbonates, e.g. cyclohexylamine carbonate. These compounds also possess, in marked degree, the property of arresting the further corrosion of iron and steel surfaces that have already become rusted by exposure to moist polluted air.

Non-stick machine parts.

Modern Packaging, 25, 116-18 (1952).

Rollers, sealers, and hoppers of packaging machines are now being coated with thin, baked-on finishes of Teflon (polytetrafluorethylene). This material is unaffected by solvents and adhesives; few, if any, materials are known to adhere to Teflon. Clean-up operations are shortened and, in some cases, accuracy of filling is improved.

PHYSICAL RESEARCH

An apparatus for electrophoresis on filter paper.

LATNER, A. L. *Biochem. J., 51,* 12 (1952).

An apparatus, on which as many as ten paper electrophoresis analyses may be run at one time, is described.

Construction, calibration and use of a light scattering apparatus for the study of macromolecules in solution.

GORING, D. A. I., AND JOHNSON, P. *Faraday Society, Trans., 48,* 367-9 (1952).

A critical examination of light scattering as a primary method for the estimation of the size of macromols. in solution is reported. For a series of well-defined proteins, mol. weights from light scattering were in good agreement with estimation by other methods.

Ion exchange resins as molecular sieves.

PARTRIDGE, S. M. *Nature, 169,* 496-7 (1952).

Suitably cross-linked exchange resins may be used as "mol. sieves" for the purpose of screening ions of small diameter from those of large diameter. The small mols. are preferentially adsorbed within the resin, while the larger mols. are screened out. The sample of resin used to separate amino acids and peptides from proteins was a sulfonated cross-linked polystyrene in bead form and of 15-30 mesh.

PATENTS (U. S. A.)

Stabilization of color in fruit.

HALL, J. E., AND HEISS, E. A. Assignors to Wallace & Tiernan Product, Inc. 2,592,563, April 15, 1952.

The process of treating fruit prior to freezing to stabilize the color thereof which comprises contacting the fruit with a water solution comprising from about 100 to about 500 parts of sulfur dioxide per million parts of water and sufficient acid to maintain the solution at a pH of from about 1.0 to about 2.5 and thereafter freezing the fruit without exposing untreated surfaces.

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Abstracts

Preservation of green color in canned vegetables.

BENDIX, G. H., HENRY, R. E., AND STRODTZ, N. H. Assignors to Continental Can Co., Inc. 2,589,037, March 11, 1952.

The process of preserving the color in canned green vegetables which consists in adding an alkaline calcium sucrate to the liquid in which the vegetables are preserved.

Method of controlling color and flavor in potato chips.

XANDER, P. A. Assignor to Wise Potato Chip Co. 2,589,591, March 18, 1952.

A process of controlling color and flavor in potato slices used in making potato chips comprising immersing sliced peeled potatoes in a sulfur-dioxide-containing bath, removing the slices and washing with water, immersing the washed slices in an aqueous solution of a reducing sugar and a protein hydrolysate derived from raw potatoes, and drying the treated slices.

Advertisers' Index

	PAGE
Alrose Chemical Co.	9
American Can Co.	3
American Optical Co.	35
Brewers Yeast Council, Inc.	39
Distillation Products Industries	7
The Diversey Corp.	31
Dodge & Olcott, Inc.	34
Felton Chemical Co., Inc.	19
Firmenich, Inc.	4th cover
Florasynth Laboratories, Inc.	3rd cover
Food Development Laboratory	40
Food Machinery & Chemical Corp.	23
Food Research Laboratories, Inc.	40
Fritzsche Bros., Inc.	40
General Foods Corp. (Diamond Crystal Salt)	37
Givaudan Flavors, Inc.	11
The Griffith Laboratories, Inc.	15
Hoffmann-LaRoche, Inc.	22
H. Kohnstamm & Co., Inc.	13
Kiwi Coders Corp.	40
LaWall & Harrisson	37
Magnus, Mabee & Reynard, Inc.	4
Minneapolis-Honeywell Regulator Co.	26-27
Norda Essential Oil & Chemical Co.	38
The Pfaudler Co.	2nd cover
Chas. Pfizer & Co., Inc.	17
F. Ritter & Co.	39
Schwarz Laboratories, Inc.	38
Shulton, Inc.	21
Foster D. Snell, Inc.	40
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The river has long been noted for its ability to produce high sets of spat or young oysters. In recent years, the State has put this characteristic to practical use through the planting of clean shells on the bottom in order to provide suitable surfaces for the attachment of young oysters. The reasons for this local high rate of setting are not thoroughly understood. A more complete knowledge of the factors which bring it about would be of great value in locating or developing other good seed areas.

It is planned to make observations

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WANTED: By Food and Agriculture Organization of United Nations for service in Mysore, India, for 6 mos. or longer, one expert (chemical engineer) in the manufacture of malted milk powder, infants' foods, etc., to advise on manufacture of such products and on selection and erection of pilot plants therefor. REPLY, L. E. Campbell, Nutrition Div., FAO of the U. N., Rome, Italy.

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CONTENTS

FACTORS AFFECTING COLOR AND FLAVOR OF SAUERKRAUT PACKAGED IN PLIOFILM BAGS. A. Sedky, J. A. Stein, and K. G. Weckel 377

GOVERNMENT CONTROLS AND FOOD PRODUCTION. L. J. Norton 380

RECOVERY OF TOMATO PROCESSING WASTES. Paul W. Edwards, Roderick K. Eskew, A. Hoersch, Jr., Nicholas C. Aceto, and C. S. Redfield 383

THE CONTROL OF "OFF-ODOR" SPOILAGE IN FROZEN CONCENTRATED ORANGE JUICE. G. L. Hays and D. W. Riester . 386

THE DETERMINATION OF A SATISFACTORY TYPE OF PACKAGING FOR THE BULK SHIPMENT OF DEHYDRATED APPLE SLICES BY FREIGHT. C. E. Felt, F. H. Cook, and L. F. Borchardt 390

STANDARD METHODS VS. PRE-ASHER APPARATUS IN THE PRE-ASHING OF HIGHLY FOAMING AND SUGAR CONTAINING PRODUCTS. Silvio Crespo 394

ON COLOR IN TOMATO PRODUCTS. M. E. Friedman, G. L. Marsh, and G. Mackinney 395

TYPES OF FOOD FOR DISASTER FEEDING. James M. Hundley . 399

FROZEN CONCENTRATED MILK. F. J. Doan 402

AFFAIRS OF THE INSTITUTE

ROSTER OF COMMITTEES, 1952-53 . . . . . *6*

REGIONAL SECTION NEWS *14*

BOOKS *20*

SELECTED ABSTRACTS *26*

Authors of papers intended for publication in FOOD TECHNOLOGY should request from the editorial office a copy of the booklet, entitled "Information and suggestions to authors." Manuscripts submitted for publication in FOOD TECHNOLOGY should follow the style described in this booklet.

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Roster of Committees, 1952-53
News of the Regional Sections
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Books
Selected Abstracts
Future Meetings

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A full roster of IFT Committees for 1952-53, supplied by President B. E. Proctor, is contained on the following pages. Owing to space limitations it has not been possible to observe formalities such as the full titles and affiliations of the committee members. The list provides a convenient source of reference for the membership at large as to the composition of the various committees and their particular spheres of activity.

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Committee on Citrus Products
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(Continued on page 10)

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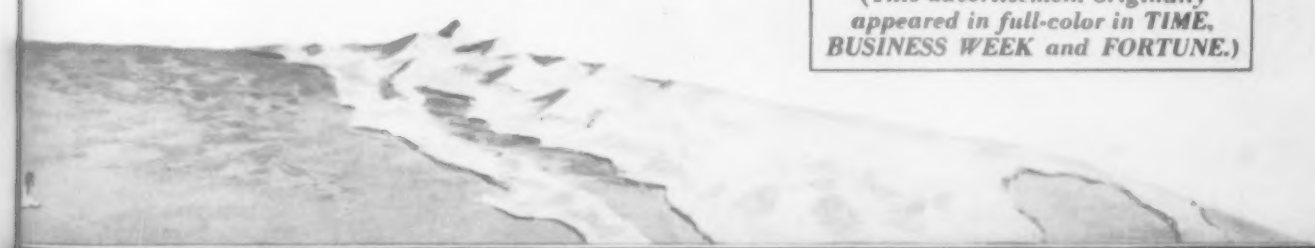

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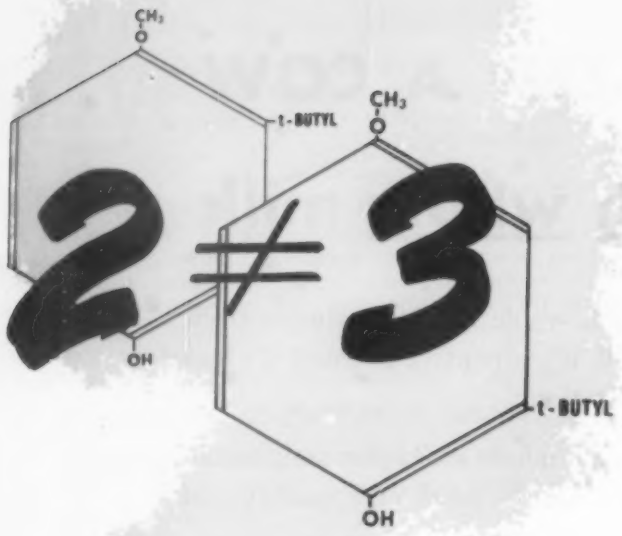

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(Continued from page 6)

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Regional Section News

CHICAGO SECTION

Members of the Chicago Section are reminded that the October meeting of the Chicago Section will be held at the University of Illinois beginning at 10:00 A.M. on October 11th. The meeting is sponsored by the Food Technology Division of the University of Illinois. It will include a tour through the University laboratories, followed by a luncheon and short talks by members of the Food Technology staff. Those present may attend a football game between the University of Illinois and the University of Washington.

As announced earlier the regular meeting date of the Chicago Section beginning in November has been moved up one week to the second Monday of the month. Meetings will still be held in the Palmer House.

GREAT LAKES SECTION

The Section reports that its opening Fall Meeting will be held on October 10, 1952, at the St. Clair Inn, St. Clair, Michigan. Word has also been received that a Winter Meeting will be held in Toledo during January and the Spring Meeting at Kellogg Center, Michigan State College, East Lansing, Mich.

INDIANA SECTION

With the May, 1952, meeting, the Indiana Section concluded a highly successful first year as a regional section, having held six meetings, attended on the average by over 50 percent of the membership.

A very interesting schedule of programs arranged by Kevin Shea of Kingan and Co. included "Home Talent" talks by Sherman Ward of Stokely-Van Camp and Lee Truman of Pest Control Services on plant sanitation, V. R. Rupp of Kingan and Co. on meat curing, and W. A. Ranzenberger on psychometric evaluation of food products. An all-day field trip with a football

(Continued on page 16)

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Regional Section News

(Continued from page 14)

game in the afternoon, was spent at the Food Technology Laboratories of Purdue University at Lafayette, Indiana, where an excellent program was provided by Drs. N. K. Ellis, N. W. Desrosier and S. Hartzell of the faculty and graduate students F. J. McCartle and F. Kellie. Other programs included talks by T. Sullivan, Head, Food and Drug Division of the Indiana State Board of Health on "meat," W. H. Bradley of Nuclear Measurements Corp. on "the determination of radioactivity in natural products," and Dr. Paul Weatherwax, Professor of Botany at Indiana University on "corn." Dinner meetings were rotated among various Indianapolis hotels and Butler University.

At the May meeting a new slate of officers for 1952-53 term elected by mail ballot (89 percent voting) was installed as follows:

Chairman—Kevin Shea, Kingan and Co., Indianapolis.
Chairman-elect—D. T. Sherow, Stokely-Van Camp, Inc., Indianapolis.
To the Executive Committee—Seb. Davin, Wm. J. Stange Co., Indianapolis; Dale Apple, Kroger Dairy Division, Indianapolis.
Secretary-Treasurer (by reappointment)—George H. F. Schnakenberg, Eli Lilly and Co., Indianapolis.
Section Councilor, N. W. Desrosier, Purdue University, term expires 1953.

Retiring chairman L. F. Rutledge was presented with an inscribed gavel as a memento to the Section's first chairman. An even more active year has been launched by the new officers and committees. Future programs are slated for an all-day sojourn to Purdue University in November and a possible joint meeting with the Ohio Valley Section in Spring of 1953. A directory committee is operating under Roy Morse of Kingan and Co. and a membership committee headed by Seb. Davin has already increased membership by over 16 percent.

At the August meeting, Section by-laws were adopted in final form. Fred Dellwo, Councilor for the Ohio Valley Section, reported on the National Councilor's meeting he attended at Grand Rapids, Michigan. Chairman Shea reported on the Section officer's breakfast. Speaker for the evening was John Taylor, Head, Dairy Division, Indiana State Board of Health.

BRITISH COLUMBIA SECTION

The British Columbia Food Technologists, which now includes the British Columbia Section of the IFT, concluded their fourth active season with their annual banquet at the University of British Columbia on June 25th. The cocktail hour was held at the Faculty Club, and the refreshments, as in previous years, were supplied by the industry. The main banquet was held at Brock Hall, the guest speaker being Dr. J. F. McCreary of the Faculty of Medicine. His subject was "The nutrition of Europe during World War II."

During the 1951-1952 season the following papers were heard:

"Seafoods without backbones," by Dr. D. B. Quayle, British Columbia Shellfish Laboratory, Ladysmith, B. C.
"The technology of meat packing," by Mr. Mel Oughton, Canada Packers Ltd., Vancouver, B. C.
"The problem of meat production," by Dr. A. J. Wood, Department of Agriculture, University of British Columbia, Vancouver, B. C.
"Recent developments in the production of hybrid vegetables," by Dr. T. H. Anstey, Dominion Experimental Farm, Agassiz, B. C.
"Yeasts and molds in the food industry," by Dr. Nora Neilson, Department of Dairying, University of British Columbia, Vancouver, B. C.
"The art and science of brewing," by Mr. A. G. Williamson, Vancouver Breweries Ltd., Vancouver, B. C.
"Dehydration of foods, including animal products," by Dr. G. F. Stewart, University of California, Davis, California.

In addition the following plant visits were made:

Imperial Plant, British Columbia Packers Ltd., Steveston, B. C.
Canada Packers Ltd., Vancouver, B. C.
British Columbia Sugar Refinery, Vancouver, B. C.
Vancouver Breweries Ltd., Vancouver, B. C.

Refreshments were served on all of these occasions.

PERSONNEL

Ned Draudt, Kingan and Co., Indianapolis, Ind., M.A. in Food Technology, will return to Ohio State in September to get his Ph.D. in biochemistry under the sponsorship of Kingan and Co.

Dr. Fred C. Blanck retired on October 1 as Administrative Fellow in charge of the Multiple Fellowship on Food Varieties sustained at Mellon Institute, Pittsburgh, Pennsylvania, by H. J. Heinz Company. In making this announcement the Institute's president, Dr. E. R. Weidlein, pointed out that Dr. Blanck has had forty years of continuous experience in research in food chemistry and technology and in the control of foods at municipal, state and federal levels. His participation in scientific work is evidenced by numerous honors. He is past president of the Association of Official Agricultural Chemists and of the Institute of Food Technologists. He has served as chairman of the Agricultural and Food Division of the American Chemical Society and of the Food and Nutrition Section of the American Public Health Association. In the latter organization and in the American Association for the Advancement of Science he is a fellow. Dr. Blanck has the additional distinction of being the first recipient of the Babcock Award of the Institute of Food Technologists sponsored by the Nutrition Foundation for distinguished service in the food field.

E. S. Stateler, food consultant for the Wahl-Henius Institute, Chicago, has been appointed professorial lecturer in food engineering at Illinois Institute of Technology. Mr. Stateler is a specialist in the field of food processing. He joined the Wahl-Henius Institute, a consulting and research facility for the brewing and baking industries, in 1951, after many years as technical editor on *Food Industries* (now *Food Engineering*) for the McGraw-Hill Publishing Company. He is a charter member of IFT.

Members of IFT affiliated with the Continental Can Co., Inc. share credit for the development of a new method of canning banana purée that will preserve the natural flavor and color of this tropical fruit.

According to C. E. Maier, General Manager of the Research Department, the new method solves one of the

(Continued on page 20 following technical papers)

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Regional Section News

(Continued from page 16 preceding technical papers)

major problems encountered in recent years by investigators who have attempted to can banana purée—it eliminates the brown or pink discoloration that commonly occurs in the processed product. This discoloration, it was found, was caused principally by enzyme activity. After making this discovery, the researchers went to work on the problem of inactivating the enzymes while still retaining the natural flavor and color of the fruit. Their investigations disclosed that the discoloration is eliminated by blanching whole, peeled bananas in hot water, steam or a combination of both for six or eight minutes or to a center temperature of 190° F. The whole bananas are then puréed in a conventional finisher or comminutor. In addition to eliminating the discoloration it was necessary to adjust the pH and sugar content of the natural fruit because of varietal differences, maturity, etc. The pH is adjusted by addition of citric acid to a range of 4.1 to 4.3 to permit low temperature sterilization and the sugar content to 30 to 40 percent to enhance flavor. The banana purée is then flash pasteurized to a temperature of approximately 200° F., filled and sealed into cans and cooled.

Books

THE PHOSPHATIDES. By Harold Wittcoff. 564 pages. Reinhold Publishing Corporation, New York, N. Y., 1951. Price $10.00.

As the publishers state, this is the first really complete work on phosphatides to appear in over twenty years, and it is one of the series of ACS Monographs. It contains, in a well-organized presentation, a discussion of essentially everything that has been printed in the field. It is particularly exhaustive with respect to the organic and physiological chemical aspects of the phosphatides, but also treats thoroughly the natural occurrence, preparation, and commercial utilization of lecithin and related phosphatides.

Through no fault of the author, the existing literature is comparatively scant in the fields relating to practical applications of phosphatides in industry, and this latter portion of the book is necessarily briefer than the earlier sections dealing with the chemistry and physiology of phosphatides. It will prove most useful to research workers who require fundamental information in this field and will fill a long-felt need for a monograph bringing up to date the extensive literature of the past two decades.

WARREN H. GOSS.

POLAROGRAPHY, Volume I, Second Edition, by I. M. Kolthoff and J. J. Lingane. 420 pages, Interscience Publishers, Inc., New York, N. Y., 1952. Price $9.00.

The authors, in writing this second edition of their comprehensive treatise on polarography written in 1941, have so increased the scope and contents that the new edition is presented in two volumes. Volume I, reviewed here, is limited to theoretical principles, instrumentation, and techniques. This is to be followed by a second volume describing inorganic and organic polarography, biological applications and amperometric titrations. New material added to Volume I are the chapters on the general characteristics of nonaqueous solvents, unusual diffusion phenomena, limiting currents that depend on reaction rates, and common operations in polarographic analysis. The addition of these new chapters and the expansion of the original chapters to include the latest advances in polarographic theory and instrumentation have made this book one of the best treatises in this important field.

Another improvement in this second edition is the use of larger print. This is especially noticeable in the improved legibility of the mathematical formulae. Some of the tables have also been revised with an improvement in both format and content. Those who are interested in diffusion current theories will find not only a complete development of the Ilkovic equation, as in the older edition, but in addition a critical appraisal of the latest proposed modifications of this equation. Of particular interest is the instrumentation section which presents an up-to-date discussion of the latest polarographic equipment and methodology. For example, they have included discussions of differential and oscilloscopic polarography, supplemented by pertinent references. It is regrettable that the authors did not append this excellent text with an index so that it would be independent of Volume II.

The lucid explanations of the theory and applications of polarography combined with extensive corroborative data will make this book valuable to students, research workers, and those interested in applied polarography.

C. RICCIUTI
C. O. WILLITS

MAN AND EPIDEMICS. By C. E. A. Winslow. 246 pages. Princeton University Press, 1952. Princeton, New Jersey. Price $4.00.

A scholarly exposition of the conquest of epidemic diseases by an obviously classical practitioner whose pre-eminence in the public health field needs no introduction to most food technologists. While this book admittedly is designed primarily for "readers among the general public who would like to know by what roads the science of public health has reached its conclusions and what results it has achieved," the author's evident admiration of the medical profession appears to have dulled somewhat his perceptions of the discoveries of scientists and the applications of technologists.

Nutritional science is not given quite the full measure of credit it deserves for aiding and abetting the general welfare of those whose life expectancies have been so spectacularly increased in recent decades with the concurrent mastery of contagious diseases. Then too, the role of food technology in enhancing the general acceptabilities of foods and in retaining their vital factors has been completely ignored. For example, in discussing the development of high-temperature short-time pasteurization of milk supplies, Professor Winslow merely mentioned that its present applications are "so accurately controlled for time and temperature as to be called as reliable as the 143° F. thirty minute

(Continued on page 26)

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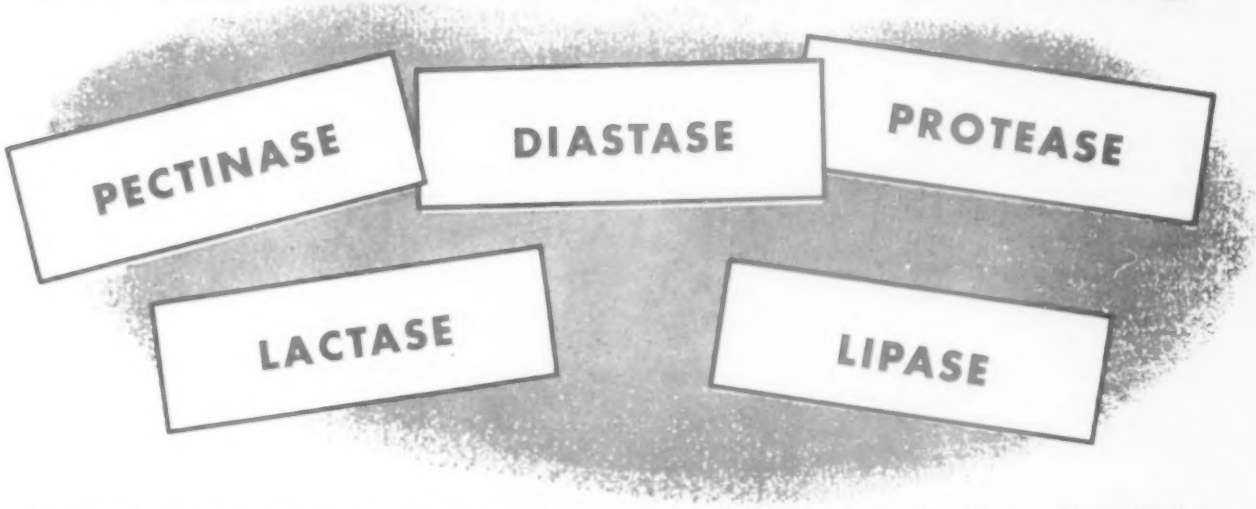

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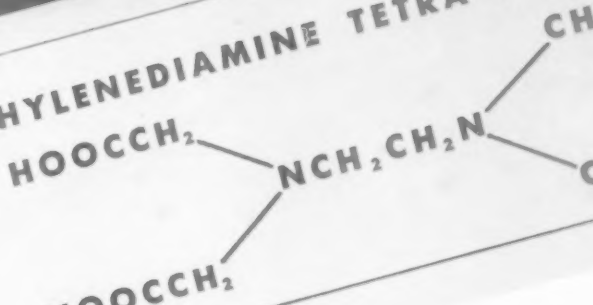

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Books

(Continued from page 20)

process." He failed to point out that this technological advance had also increased the market by increasing the quantity consumed because of the improved flavor acceptability of milk so processed—certainly a development worthy of passing comment as an increment in advancing public health. Incidentally, he also missed the opportunity afforded to recount for the reader the meticulous studies and engineering triumphs of Leslie Franks and his co-workers in assuring the reliability of control upon which both the public health protection and enhanced acceptability are dependent.

It seemed to this reviewer that the general reader might gain the impression that most of the significant advances in the field of public health are the result of an omniscient role imputed to the medical profession by the author. As a matter of fact, they are due more to the skillful implementation of scientific discoveries and to the timely encouragement of technological applications by that profession. Then too, it would appear that the author has really not borne witness to the evolution of a *science* of public health but rather to a *movement* that marshalled sciences and technologies and wrote a record of human achievement that is one of the most outstanding of the Twentieth Century.

The professional worker in the fields of public health and food technology will find the chronology of progress as documented by Professor Winslow a rich source of historical and philosophical references. And in spite of some of the critical lapses mentioned herein, the general reader will find this book presents a fascinating review of the present engineering practices, administrative methods and scientific means of control of epidemic diseases. Also this book mirrors not only the author's confident charm but his own considerable contributions to the public health progress of the United States and the world during the past hundred years.

MILTON E. PARKER.

Selected Abstracts[a]

ANALYTICAL METHODS

Progress in organic microanalysis, particularly in the determination of functional groups.

LIEB, H. *Chimia, 6,* 34-9 (1952); *Brit. Abstracts, C, 202,* No. 1483 (1952).

A review. Micro-methods for elementary analysis and for the detn. of alkyloxy, acetyl, carbonyl, *N*-alkyl, and C- or S-methyl groups, active H, and double bonds are discussed.

The colorimetric microestimation of human blood cholinesterases and its application to poisoning by organic phosphate insecticides.

METCALF, R. L. *Jour. Econ. Ent., 44,* 883-90 (1951); *Biol. Abst., 26,* 1039, No. 11230 (1952).

A colorimetric method for the detn. of human plasma and red cell cholinesterases on finger puncture blood was developed using as little as 1 μl of plasma. Method may be used in detg. dangerous overexposure to org. phosphate insecticides and pharmaceuticals, and in studies of the action of these materials on lab. animals.

[a] These Selected Abstracts are made available to FOOD TECHNOLOGY through the cooperation of Associate Editor H. A. Campbell and the General Foods Corporation of New York, N. Y. The abbreviations found in these abstracts are similar to those used by Chemical Abstracts.

(Continued on page 28)

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DIAMOND CRYSTAL SALT with Antioxidant

Abstracts

(Continued from page 26)

A polarographic method for the estimation of tetrachloronitrobenzene residues on potatoes.

WEBSTER, J. G., AND DAWSON, J. A. *Analyst, 77,* 203-07 (1952).

A method is described for the polarographic estn. of small amts. of tetrachloronitrobenzene. Details are given of the application of this method to the detn. of tetrachloronitrobenzene residue on potatoes. Recovery rates are shown to be of the order of 84 to 93% from tubers treated with 10 to 500 μg. of tetrachloronitrobenzene.

BIOLOGICAL SCIENCES

BIOCHEMISTRY

Enzyme evaluation by viscosity reduction.

NICKERSON, R. F. *J. Am. Leather Chemists Assoc., 47,* 165-78 (1952).

An improved method of detg. proteolytic enzyme activity is described. The viscosity of a standard gelatin sol. contg. enzyme is detd. several times in sequence at 5-min. to 10-min. intervals. The observed viscosities are transformed to fluidities by a simple graphical procedure. Fluidities, plotted against time, yield straight lines with slopes proportional to enzymic activity. Details of method and calcn. are given. It is demonstrated that enzyme activity is not lost through combination of enzyme with gelatin split products. The method can be used in the investigation of hates.

Activity of pepsin.

Nutritional Revs., 10, 88-9 (1952).

By the use of the film monolayer technic, Currie and Bull have shown that pepsin acts as a proteinase below pH 2.25, and as a peptidase above this pH, the two actions being mutually exclusive. Time did not affect the ultimate mol. wt. distribution. The degree of fragmentation increased with pepsin concn. and temp. increase. It was concluded that pepsin has two distinct, though related functions.

Effect of phosphorylated hesperidin, a hyaluronidase inhibitor, on fertility in the rat.

MARTIN, G. J., AND BEILER, J. M. *Science, 115,* 402 (1952).

Phosphorylated hesperidin was found to be an effective antifertility agent, whether administered intraperitoneally or orally. Results reported, although striking, must be considered to be preliminary because of the small number of animals used.

The histamine hypothesis of the biological effects of radiation.

ELLINGER, F. *Schweiz Med. Wochenschr., 81* (2) 55-67 (1951); *Biol. Abstracts, 26,* 1311, No. 14405 (1952).

The importance of histamine, acetylcholine and adenosine compds. for the explanation of radiation effects is discussed in detail. On the basis of exptl. evidence histamine appears most readily to account for the production of local as well as systemic radiation effects.

Clinical use of fat injected intravenously.

VAN ITALLIE, T. B., WADDELL, W. R., GEYER, R. P., AND STARE, F. J. *A. M. A. Arch. Internal Med.,* Chicago, *89,* 353 (1952); *J. Am. Med. Assoc., 149,* 966 (1952).

Fifteen of the 35 patients given fat emulsions intravenously, received 5 to 30 sep. infusions. Each received at least 500 cc. and several as much as 2000 cc. at one time. The prepns. contained fat in concns. of 10, 12.5, and 15%, providing 1100, 1325, and 1600 calories per liter. The fat emulsions were prepd. by homogenization, using a phosphatide stabilizer and a co-

(Continued on page 30)

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Abstracts

(Continued from page 28)

stabilizer in low concn. The prepn. contained particles averaging less than 1 μ in diameter and is stable to autoclaving. If prolonged parenteral feeding is necessary, the patient's survival may depend on the fat (the calories provided therein) given intravenously. In an actual case, a liter of fat emulsion providing 1600 calories can be given in 120 minutes or less. Clearance of fat from the blood stream usually is complete after 4 or 5 hours, and there has been no clinical evidence of ketosis during or after the fat administration. Among hundreds of patients receiving the fat intravenously, there has never been a fatality attributable to the prepn. Liver function tests show no evidence of liver damage. Untoward effects, probably due to occasional impurities have been observed—nausea, transient flushing of face and neck, moderate fluctuation in blood pressure. Certain batches of fat emulsion proved pyrogenic, others not. Tachyphylaxis occurs after a small amt. of the prepn. has been administered; vasomotor reactions do not recur with early subsequent administration of the fat emulsions.

Clinical use of therapeutic agents containing chlorophyll.

SERLING, M. E. *Vet. Med., 57*, 155-6 (1952).

Highly-purified, water-sol. chlorophyll applied topically in either ointment or soln. form has many uses in the everyday practice of veterinary medicine. In the treatment of burns, surgical or traumatic wounds, moist and dry eczemas and other skin eruptions, and in ulcerous pathogenic conditions of the ear, these prepns. have proved remarkably effective in accelerating the healing process. End results have been excellent, and in particular, scar tissue has been reduced to a min. The water-sol. prepns. are non-toxic and can be used freely in all animals, either alone or in conjunction with the accepted therapeutic agents.

Chronic trichloroethylene poisoning.

LACHNIT, V., AND RANKI, W. *Ztschr. Unfallmed. u. Berufskrankh, 43*, 334-341 (Dec. 15), 1950; *Archi. Ind. Hyg. Occup. Med., 5*, 401 (1952).

Trichloroethylene, $CHCl{-}CCl_2$, is widely used in industry as a solvent, for degreasing, and as a disinfectant, and in the chem. industry, yet its toxicity is underestd. by workers and even by physicians. Acute poisoning, which is relatively infrequent, is seldom missed, but the chronic effects, which vary much with individuals, are even more important. The authors have studied the problem presented by the lack of a simple routine quant. method of testing for trichloroethylene or its decompn. products in the blood or the urine. Supervision is especially necessary at industrial processes where the open use of trichloroethylene cannot be prohibited. With prolonged exposure trichloroethylene showed the characteristics of a liver poison; these can be detected only by using exact chemical examn. and applying a series of tests for liver function; neurological symptoms are important in slight degrees of intoxication.

MICROBIOLOGY

Disinfective action of methyl bromide, methanol, and hydrogen bromide on anthrax spores.

KOLB, R. W., SCHEEITER, R., FLOYD, E. P., AND BYERS, D. H. *Archi. Ind. Hyg. Occup. Med., 5*, 354-64 (1952).

(Continued on page 32)

Schwarz

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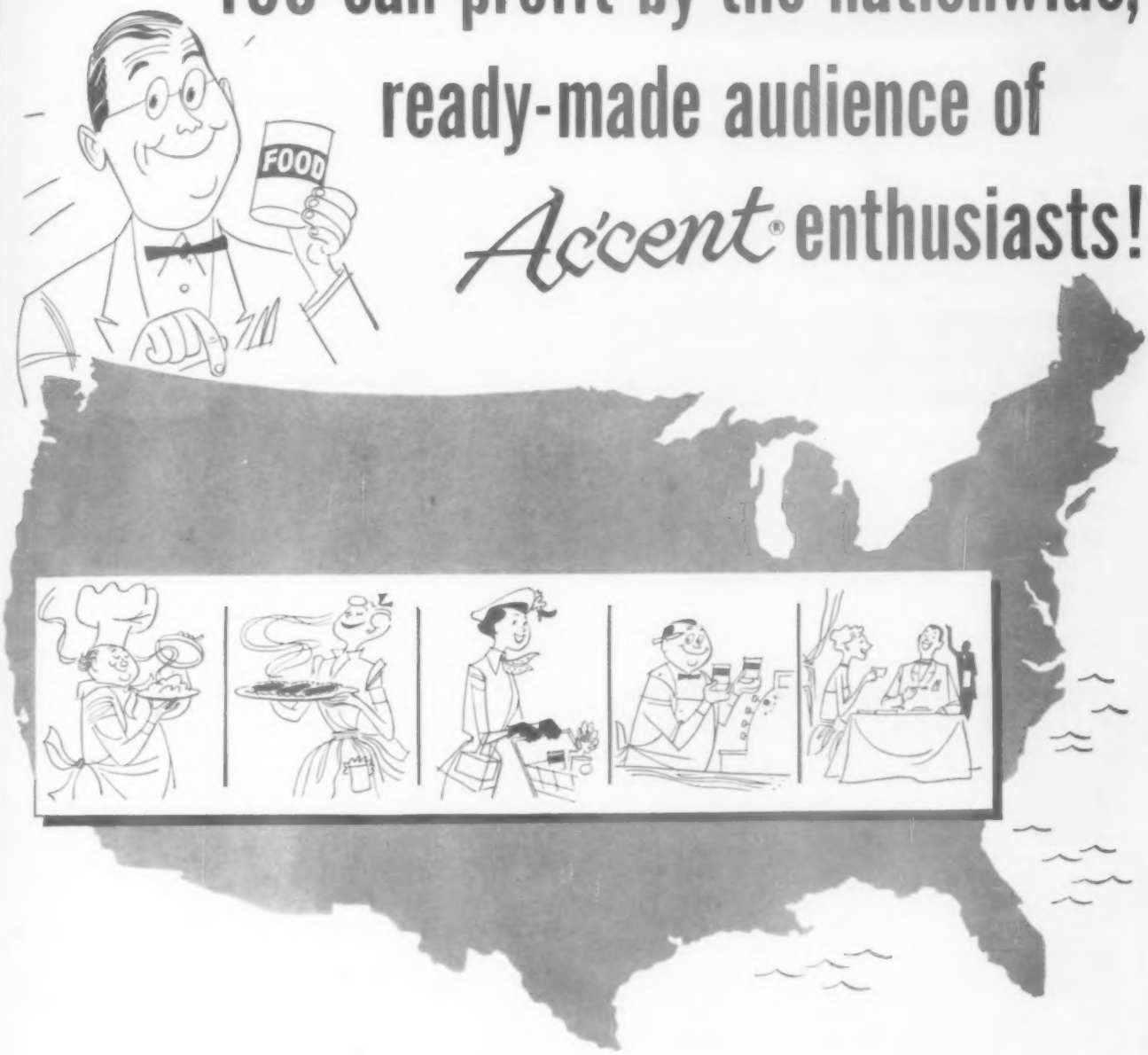

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Abstracts

(Continued from page 30)

The results of studies of the efficacy of methyl bromide (CH_3Br), hydrobromic acid (HBr), and methyl alcohol (CH_3OH) for the disinfection of anthrax-contaminated materials are presented. It was demonstrated that in the presence of moisture 3.4 to 3.9 gm. of gaseous CH_3Br per liter was capable of disinfecting com.-sized rolls of hair and bristles after 18 hours' exposure at room temp. without causing any apparent damage to the materials. The presence of moisture was shown to be essential in the destructive action. Hydrogen bromide, as a gas or in soln., was shown to be capable of killing *B. anthracis* spores at concentrations considerably greater than those which might be produced by normal hydrolysis of CH_3Br. Methyl alc. exhibited no killing power on *B. anthracis* spores at any concns. tested (0.004 to 95%). Methyl bromide is believed to offer potentialities as a general nondeleterious disinfecting agent for contaminated industrial materials.

The effect of oxidative rancidity in unsaturated fatty acids on the germination of bacterial spores.

ROTH, N. G., AND HALVORSON, H. O. *J. Bact., 63,* 429-35 (1952).

Rancid corn oil and lard inhibited germination of spores of a putrefactive anaerobe whereas non-rancid samples had no effect. Oleic, linoleic and linolenic acids and their methyl esters were inhibitory only when rancid. Benzoyl peroxide gave the same inhibition while catalase partially reversed the inhibitory effect of the rancid fats.

The composition of the bulk proteins of Chlorella.

POWDEN, L. *Biochem. J., 50,* 355-8 (1952).

A representative sample of the proteins of the alga *Chlorella vulgaris* was prepd. The amino-acid compn. of this protein fraction was investigated by the technic of paper-partition chromatography after an acid hydrolysis during which no humin formation occurred. The analysis accounted for 101.3% of the total protein nitrogen. The amino-acid compn. of this algal protein fraction is compared with figures available for the compn. of the proteins obtained from the leaves of the higher plants and of the proteins found in a sample of a brewer's yeast.

FUTURE DATES FOR FOOD TECHNOLOGISTS

Oct. 18-22	American Bakers Association, Chicago, Illinois
Oct. 20-22	Fall Meeting, American Oil Chemists' Society, Cincinnati, Ohio
Oct. 20-22	Annual Forum of Packaging Institute, New York, New York
Oct. 21-24	American Dietetic Association, Minneapolis, Minnesota
Nov. 10-12	National Academy of Sciences, St. Louis, Missouri
Nov. 17-20	Annual Convention of the American Bottlers of Carbonated Beverages, Atlantic City, New Jersey
Nov. 30-Dec. 3	Forty-eighth Annual Meeting of the American Society of Refrigerating Engineers, New York, N. Y.
Dec. 7-10	American Institute of Chemical Engineers, Cleveland, Ohio
Dec. 28-31	One hundred and nineteenth Meeting, American Association for the Advancement of Science, St. Louis, Missouri
1953	
Mar. 15-18	One hundred and twenty-third National Meeting of the American Chemical Society, Los Angeles, California
June 21-25	**Thirteenth Annual Meeeting of the Institute of Food Technologists, Boston, Massachusetts**

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CONTENTS

THE USE OF MONOSODIUM GLUTAMATE IN FROZEN FOODS. Karl B. Norton, Donald K. Tressler, and Lillian D. Farkas . . . 405

PREPARATION AND EVALUATION OF DRIED CITRUS PEEL AS A PECTIN SOURCE MATERIAL. A. D. Shepherd and R. P. Graham . . . 411

PRODUCTION OF PASTEURIZED FROZEN EGG PRODUCTS. A. R. Winter . . . 414

FOOD PLANNING FOR INFANT FEEDING. Lillian S. Coover . . . 416

A METHOD FOR REMOVAL OF PEEL OIL FROM CITRUS JUICES AND PROCESS LIQUIDS. Richard W. Wolford, Vincent D. Patton, and Robert R. McNary . . . 418

EFFECT OF SUBTILIN ON SPOILAGE OF THERMAL PROCESSED BEEF. A. T. Adams, J. C. Ayres, R. G. Tischer, and B. Ostle . . . 421

CERTAIN PARTIAL ESTER EMULSIFIER LEVELS IN FOOD. C. D. Pratt . . . 425

IMPROVEMENTS IN THE CANDYING OF FRUITS. F. E. Atkinson, C. C. Strachan, A. W. Moyls, and J. A. Kitson . . . 431

WARFARIN AND PERIMETER RODENT CONTROL. William D. Fitzwater, Jr. . . . 436

COMPARISON OF FROZEN AND DEHYDROFROZEN PEAS WITH FRESH AND STORED POD PEAS. Mildred M. Boggs and W. F. Talburt . . . 438

AFFAIRS OF THE INSTITUTE

PRESIDENTIAL ADDRESS OF DR. CHARLES N. FREY . . . *4*

REGIONAL SECTION NEWS . . . *12*

BOOKS . . . *18*

SELECTED ABSTRACTS . . . *24*

Authors of papers intended for publication in FOOD TECHNOLOGY should request from the editorial office a copy of the booklet, entitled "Information and suggestions to authors." Manuscripts submitted for publication in FOOD TECHNOLOGY should follow the style described in this booklet.

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PRESIDENTIAL ADDRESS OF DR. CHARLES N. FREY

Delivered at the Twelfth Annual Meeting of the IFT
Grand Rapids, Michigan, June 9, 1952

At the close of his year in office it is traditional for the president of the Institute to open the annual meeting with an address devoted to the broader implications of the profession of food technology. These addresses have been uniformly fine, and each has made a special contribution toward the maintenance of high standards and sound objectives in the field of food science and engineering. Dr. Frey's address, latest in the series, will appeal to all groups, but it might well be considered "required reading" for those young men and women who have elected food technology as a career.

FUNCTION OF THE FOOD TECHNOLOGIST IN MODERN INDUSTRY

Charles N. Frey

Food technology has been defined as the application of science and engineering to the production, processing, packaging, distribution, preparation, and utilization of foods. Knowledge of food technology enables its possessor to solve technical problems in one or more of these fields by the application of one or more of the physical-biological sciences or branches of engineering. It may involve problems in the development of products, processes, or equipment, the selection of raw materials, the fundamental changes of composition or physical condition prior to, during, and subsequent to industrial processing, or the nutritional value and health factors involved in connection with the use of foods.

The Food Technologist's Training and Background

The question immediately arises as to the training required to prepare a man for the responsibilities enumerated above. Should a man have training chiefly in chemistry or in engineering with good fundamental training in biology and biochemistry, or should he have a balanced combination of the three basic fields? How intensive should this training be? Is a four year course leading to the B.S. degree adequate? One of the leading educational institutions has established a course in Food Technology leading to the degree of B.S. in Food Technology, having the following outline:

First Year

First term:	Second term:
Engineering Drawing	Chemistry
General Chemistry	Physics
Physics	Descriptive Geometry
Humanities	Humanities
Calculus	Calculus
Military Science	Military Science

Second Year

First term:	Second term:
Qualitative Analysis	Quantitative Analysis
General Biology	General Biology II
Physics	Physics
History—Humanities	History—Humanities
Calculus	Differential Equations
Military Science	Military Science

Required During Summer: Organic Chemistry

Third Year

First term:	Second term:
Physical Chemistry I	Physical Chemistry II
Physical Chemistry Lab.	Physical Chemistry Lab.
Humanities, Economic Prin.	Tech. & Chem. Food Sup.
Tech. & Chem. Food Sup.	Industrial Microbiology
Bacteriology	Humanities III
Elective	Elective

Fourth Year

First term:	Second term:
Food Engineering	Food Engineering
Biochemistry	Tech. of Food Products
Tech. of Food Products	Chemistry of Nutrition
Chem. Eng. Food App.	Chem. Eng. Food App.
Thesis	Thesis
Humanities IV	Humanities IV

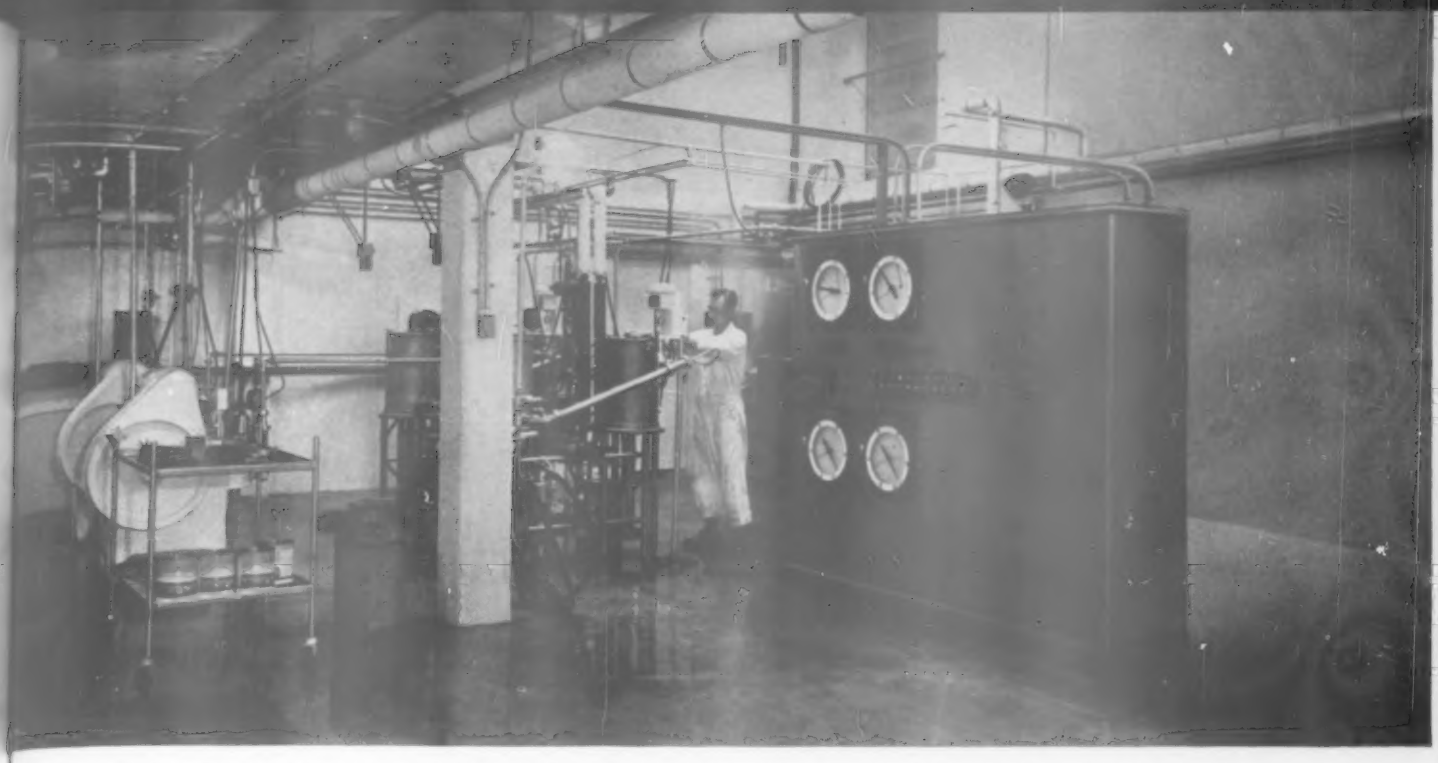
A group of selected students is chosen during the third year to take a modified fourth year course to be followed by a fifth or graduate year, during which six months are spent in industry. This course leads to a B.S. and M.S. in Food Technology. In the fifth year the Thesis is prepared, and work on Enzymology, advanced Food Technology, Seminar, and an elective are taken up. This program is an intensive system of training, but it is justified in terms of the vast and varied problems which face the technologists. In addition the Department grants the Ph.D. degree after an appropriate period of training. Men with the Ph.D. degree are prepared for research and management responsibilities.

The Institute of Food Technologists has defined its professional members as follows:

Art. VI, Sec. 2. "Any person who is ethically qualified, and who has had training and experience in food technology as defined in Article V, or any person who in the opinion of the Council is recognized as distinguished in the contributing sciences as they apply to foods, shall be eligible to be a Professional Member of the Institute. The minimum training which shall qualify a candidate for eligibility for Professional Member is, in general, graduation from a college, university, or similar institution in which he has majored in one or more of the sciences or branches of engineering associated with food technology. The minimum experience which shall qualify a candidate for eligibility for professional membership shall be three years experience in food technology. The Council may, at its discretion, waive any or all of the foregoing requirements in the case of a person who, through long experience has distinguished himself in the field of food technology."

Section 3. Members. "Any ethically qualified person, active in special or limited aspects of food technology as defined in Article V, who is an administrator, director or executive under whose jurisdiction operations in food technology are conducted; or who is engaged in the dissemination of knowledge of food technology; or one whose work requires a general knowledge of the broad principles of food technology as it applies to the products, processes or equipment with which he or she is concerned, or one scientifically trained in and who has entered a

(Continued on page 8)



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The ingenuity and experience gained through many years in all types of industrial activity, plus specialized knowledge of food processing applications, enables Honeywell to bring some of the toughest quality problems of the industry under automatic control.

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Other major improvements are being made in a great variety of food processing operations . . . and Honeywell engineers are continuing to cooperate with scientist and production man alike, to speed the newer techniques from the laboratory to actual process use. Our local engineering representative will welcome the opportunity to discuss advanced instrumentation for your processing operations . . . and he is as near as your phone.

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President's Address

(Continued from page 4)

career in food technology; shall be eligible to become a Member."

The Institute also provides for student memberships.

It will be noted that the Institute recognizes that one who has distinguished himself in making contributions to the supporting sciences may be given membership. It also recognizes that one who has through long experience distinguished himself in the field of food technology may be given membership regardless of his scholastic qualifications.

The food industry is a vast enterprise. In the United States it accounts for one fifth of the national income in dollars, a sixty billion dollar industry. The future development of the food industry is potential in the research laboratories. The advances made in science and industry are created by men who have learned to use the wisdom and experience of the past, and who have the insight to see the pattern of the future. To manage and supervise the scientific, technical, engineering and regulatory problems involved requires men of broad experience and training.

The vision and energy of modern management of which the food technologist should be an integral part is the magic wand which translates the discoveries of the laboratory into the new products purchased by the consumer.

One of the aims of the courses given to food technologists should be training for management. It is being recognized by industry that the type of scientific training mentioned previously, or similar training, especially in the fields of chemistry, bacteriology, and engineering develops men capable of assuming the great responsibilities involved in operating a large, modern industry. The membership of the IFT contains a notable list of business executives.

The Food Technologist in the Modern World

The food technologist occupies a critical position in respect to the public, to government, and to industry. He should be conscious of his ever expanding responsibilities. He must clarify the problems confronting the food industry, and enlighten the public as well as certain government agencies on the use of some of the products employed by the manufacturers. Today we hear a great deal about the use of chemicals in foods. Management uses chemicals at the suggestion of the food technologists. The technologist is aware of the function which various chemicals perform in relation to the ultimate food value of the product chemically treated. It is the responsibility of the technologist to keep management adequately informed in respect to every aspect of this complex situation, involving nutritional and legal problems. The technologist should be able to hold a position in management enabling him to assist in formulating policies. Development of policies is the function of management, and in the formulation of policies, broad technological knowledge is necessary.

The food industry is continually facing new responsibilities. In the early days of our country food preparation was carried on chiefly in the home and in small establishments. Today food preparation has become largely a matter of factory production. A large part of our food has had some type of processing before it reaches the consumer's kitchen. Many of the foods are processed, ready to serve at the table, and require no further treatment than heating or dilution.

The food industry has succeeded in mastering the problems of sanitary control of the plant and of the products involved in processing. During the last 20 years it has also become aware of the fact that some types of processing destroy a variable percentage of important factors in the diet which are of prime importance in nutrition, namely vitamins and amino acids. It has also been discovered that losses in minerals and carbohydrates may occur, and there are interactions of various components during heating and subsequent storage. The destruction of flavor during processing and storage of food, and conditions which affect shelf life, such as losses by excess moisture, oxidation, heat and light, must be taken into consideration. This newer knowledge derived from biochemists, chemists, engineers, biologists and technologists must be integrated by the food technologist. The newer knowledge of nutrition has opened vast fields of activity for the food industry. Related sciences, such as genetics, may affect it vitally. The protein, fat and starch content of certain plants may be so altered by the geneticist that consideration of its changed values by the nutritionist or food manufacturer is necessary. Upon the food technologist rests the responsibility of integrating the newer knowledge coming from a multiplicity of sources and applying it to production and manufacturing.

Industry is responsive to the needs of the consumer and his demand for improved plant sanitation, better quality, better flavored and more nutritious foods. It is also aware that government has certain responsibilities in this field. Labeling problems and standards, and in general, government regulations and all the legal aspects, come into the province of the technologist. This is a vast field, and in spite of the fact that prodigious efforts are required to master the problems, the technologist cannot for a moment relax his efforts to maintain close contact with every new development.

The food industry has faced its responsibilities with the purpose of improving its products and making them more acceptable to the consumer. Scientifically and industrially our standards have been high. The technologist has kept in mind the protection of the consumer by avoiding the introduction of substances that might be harmful, or that are toxic at levels which would be used in food products. Industry is constantly on the alert to improve the physical as well as the nutritive properties of the products it produces. Mechanical operations often develop unfavorable reactions which tend to destroy the acceptability of the product. The technologist attempts to eliminate these difficulties in order to gain consumer acceptance. To control manufacturing operations, or the stability and uniformity of a product, often necessitates the introduction of chemical compounds. Modern industry could not operate without chemicals. It is to the credit of the food industry that it has always maintained high standards, and that no substance detrimental to the health of the public has been employed by any group of manufacturers. According to the report of the Food Protection Committee of the National Research Council, "All the evidence accumulated to date indicates that the public interests are being well protected." The record of the food industry is an excellent one largely due to the efforts of food technologists, food chemists, biochemists and bacteriologists. Food technologists have become familiar with toxicological procedures and have initiated studies designed to show the hazard, if any, of chemicals which are to be employed in food processing and preservation.

The food technologist, as part of management, and government agencies are faced with a group of problems focusing on the common objective of insuring adequate and wholesome food within the complex evolution taking place in agriculture, chemistry, physics, medical sciences, and the food industry. As food technologists we face ever expanding responsibilities as the food industry develops new methods and new processing procedures. This progress must keep pace with the rapid developments in fields having a bearing on the food industry. Food technologists also have an increasingly important role in developing the potentialities of our agricultural production, and in extending our food supplies by complete utilization of perishable products and the prevention of deterioration by better preservation. It is their responsibility to clarify the practices of the food industry for the benefit of the public and for the various interested government agencies.

(Continued on page 10)

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President's Address

(Continued from page 8)

The Food Technologist and Fundamental Research

At this time it may be appropriate to discuss briefly the relation of the food technologist to fundamental research work. In the years prior to World War II, and especially prior to World War I, a large part of the fundamental scientific work in the world was produced in western Europe and Great Britain. We have led in the field of application, but in the abstract realm of pure science, we have been less productive.

You may think that we have had ten years of research activity of unprecedented scope. However, part of this research was for war purposes, but there have been many peace time applications. The important observation is that many of these developments have been based on fundamental studies carried on in Europe and America prior to the war. During the war years and shortly thereafter, few basic discoveries were reported, and applied research approached the field of pure research. Further advance in some fields must await the progress of fundamental work. Europe is not in position to carry on the vast explorations in fundamental work it formerly supported. In many countries the environment for carrying on fundamental work is lacking and men labor under great difficulties. Funds are limited, and laboratories do not have modern equipment. It becomes necessary for America to assume a larger place in this field in order to maintain the accelerated pace which our industrial development demands.

Many educational institutions have not placed sufficient emphasis on fundamental work. Some of our industries have also failed to support fundamental work in their own laboratories or in the universities to the degree consistent with the requirements of industrial progress. It will be necessary to change the environment in some of our universities, and industry will find it desirable to increase its support of fundamental work. Many industries, such as American Telephone & Telegraph, General Electric, du Pont, Merck & Company, and others have assumed large responsibilities in this area, and have also carried on a vigorous program of fundamental work in their own laboratories. The food technologist should give serious consideration to the research required in the fundamental fields underlying his activities, and should use his influence in guiding management in sound but advanced thinking. Government can assist by giving industry a better tax situation. The progress of fundamental research must be accelerated if we are to maintain our industrial leadership in the world and give our people full employment.

The Food Technologist and the Future

In America we had the frontier until recently. Man has been in the fortunate position of being able to move to new lands when population increased or economic conditions became unbearable. Most of the desirable areas of the world are under cultivation, and those great days when good land was almost free, are gone forever. Future generations, unless atomic bombs destroy large masses of people, will look upon our age as one of the great epochs in which freedom for man to select his way of life and to live in an environment largely of his own making was possible. Today our frontier is the human mind. In 1933-1934 during the depression we had a school of economists and men in leadership who believed we had reached our apogee. The frontier was gone. Some of our leaders advocated that we should level off, cut down our working hours, spread labor, reduce the plans for expansion, and live in a mature economy.

In the laboratories of industry and of the universities men were at work, and we obtained penicillin, nylon, sulfa drugs, knowledge of vitamins, hormones, human and animal nutrition, radar, television, proximity fuses, greater insight into the atom, the liberation of atomic energy and hundreds of other great contributions. These are frontiers of greater expanse than the broad Mississippi valley. Research is the force that liberates and advances mankind. Without knowledge of science and its application man would not have been able to accomplish the social changes and improvements in material environment that make the life of the working man in many respects more livable than that of a king a century ago.

Over one hundred years ago Malthus predicted that food production and population increase would intersect in the near future, and mankind would be in dire peril of starvation and disease. But science stepped in, and the prospects for postponing the Malthusian Götterdammerung look more favorable than they did one hundred years ago. At that time it took nine farm workers in America to produce sufficient for themselves and one city worker. Today one farm worker supports himself and fourteen city workers. We are aware of the part science has played in this transformation. Chemists and engineers, together with botanists, bacteriologists and food technologists, have extended the value of foods by feeding appropriate combinations, and preserved them by modern techniques. Sixteen million tons of fertilizer per year have given us the equivalent of fifty million more acres of land. The population has been protected by chemically fortified foods, and pesticides have insured crop production. Maynard, addressing the meeting of the Federated Biological Societies, New York, 1952, stated that our population can be tripled if we use the foods now fed to animals for feeding humans, relying on animals only to the extent to which they can be grown on grazing lands unfit for agriculture. He does not advocate this solution. The American people are not ready to be Chinafied in spite of the rapid growth of our population from 75 million in 1900 to 150 million in 1950. The use of B_{12} and antibiotics will undoubtedly enable us to grow animals chiefly on a cereal diet, and geneticists are producing better proteins in cereals, thus extending our protein supply. Blaxton, an English scientist, gives us figures that are significant: 1 acre of wheat produces in calories food for 2.4 people per year, lysine 1.8, calcium 0.3, and no vitamin A, C, or D; 1 acre produces milk sufficient to feed in calories .6 of an individual, lysine 4.1, calcium 3.6, and vitamin A 2.0.

There are large areas, however, where misery and starvation still are the accepted fate of a large portion of the population. How long can we keep hunger and revolution from our doors if we cannot raise the level of production in countries like India and China, and obtain some degree of stabilization in the population. It is their problem, but we have the scientific knowledge, ability to produce the mechanical equipment and chemical products which combined with our techniques will increase the productivity of these lands 50-100%. How can we assist these people to help themselves is a problem which statesmen have not solved. In India and Pakistan food production is near the 1939 level, but the population has increased to 430 million, from a population of 294 million in 1901. Food production for

(Continued on page 12)

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President's Address

(Continued from page 10)

the entire world is 9% greater than in 1938, but population increased 12%. In the United States food production increased 10%, population 14%. In this field the food technologist may have more significant and potentially greater effectiveness than the politician.

Inventions and patents are also matters that should concern the food technologist. While patents have fared badly in the courts and patent office, a recent decision by the Supreme Court, sustaining the validity of certain clauses in a chemical patent, is a healthy sign and indicates a change of view on the part of the court. We should not relax our efforts in this field. The technologist is in an excellent position as an integrator of various fields to see the usefulness and value of invention, and to make contributions in his own right. He should become familiar with the entire field of patent activity of his company, and contribute to its operation. His responsibility in protecting the interests of his company becomes very great.

Sales and purchases are an important aspect of business operation. The food technologist by suitable conferences can continually advise and educate his purchasing and sales people. They in turn will give him an almost daily interpretation of the consumer and his problems. This information is of the greatest importance to the technologist, the laboratory and the organization.

Needless to say, the ideal technologist should be well trained, an excellent administrator, have a fine personality, presence, and the ability to handle people and to write good reports. He should be a man of the highest character and integrity. The research leadership he can give will place his company ahead of competitors because the superiority of his research expresses itself in better products, better consumer acceptance, and superior use and selection of the raw materials. As research director he should develop his men to independent thinking, keep them informed on all phases pertaining to the operations of interest to them. Each man should be developed to his utmost capacity so that he can face new and unfamiliar situations with competence and sound initiative. Universities and colleges may find it of interest to give some instruction in business administration and patent law to enable the graduate to have more perspective and insight to meet the requirements which industry demands of him.

And finally the food technologist should be interested in his community and in the affairs of the nation. The impact of science is upsetting ways of life that have existed unchanged for centuries. The scientist should not be indifferent to the consequences of his own activity. As the historian, Charles Beard, so ably remarked, "Are they (scientists) to regard themselves as the members of a privileged guild entitled to go their own way without reference to the fate of society?" Management also should courageously face its responsibilities in this area. Progress through science is not an accident, for science is a necessity for progress. This progress, however, must be utilized wisely by society.

Modern laboratories give men opportunities of almost unbelievable scope. The young men who have the good fortune to love science, to have curiosity concerning the nature of the world around them, and the ability to labor patiently and serenely, have before them a future of magnificent possibilities. They will be able to fulfill the ideals of the philosopher, William James, who stated, "The great use of life is to spend it for something that will outlast it."

Regional Section News

AUSTRALIAN SECTION

After a poll of members throughout Australia, it was decided to divide the Australian Section into two separate Regional Sections of the Institute. An application has been sent to the Executive committee requesting that the name of Section No. 19 be changed to Australia Northern Section, with geographical boundaries including the States of New South Wales and Queensland, and that a new Section be created to be known as the Australia Southern Section, to cover the States of Victoria, Tasmania, South Australia and West Australia. It is hoped eventually to establish separate sections in each of the States.

A dinner meeting was held in Sydney on September 1st, at which a film made at the Hawkesbury Convention was screened. The programme also included an address by Mr. W. S. Beale of Gordon Edgell & Sons Pty. Ltd. who spoke on vegetable canning in California, and illustrated his talk with color slides.

New officers for Section No. 19 are: Chairman, A. T. Roche; Vice-Chairman, J. R. Vickery; Secretary, V. M. Lewis; Treasurer, E. G. Davis; Councillor, J. F. Kefford. For the proposed Australia Southern Section, the officers are: Chairman, F. C. Elsworth; Vice-Chairman, H. G. Jessep; Secretary, Miss M. K. Paxton; Treasurer, K. B. Smith; Councillor, G. F. Midwood.

CHICAGO SECTION

The November meeting of the Chicago Section will be held at the Palmer House on Monday, November 10th. Randall Royce of the American Can Company will speak on "Trends in the Tin Can Industry." He will discuss some of the current trends in materials, construction, and the use of metal containers for foods.

On Monday, December 8, Mr. P. A. Goeser of Swift and Company Research Laboratories will speak on "The Art of Carving." This will be a discussion plus a demonstration on the carving of several types of cooked meats.

PHILADELPHIA SECTION

The Section held its September meeting on Thursday, September 18th, 1952, at the Whittier Hotel, Philadelphia, Pennsylvania.

Speaker at this opening dinner meeting of the Fall Season was Mr. Harry E. Whitmore, Sales Manager in charge of Food Antioxidants for the Universal Oil

(Continued on page 14)

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Regional Section News

(Continued from page 12)

Products Company, Philadelphia, who discussed the subject of "Antioxidants Now Stabilize Eleven Food Types."

WESTERN NEW YORK SECTION

The first meeting of the Section's 1952-53 season was held on Tuesday, September 30th, at the New York State Institute of Applied Arts and Sciences, Buffalo, New York.

Mr. Allen T. Retzlaff, Chief of the Buffalo office of the Food and Drug Administration, was the dinner speaker, discussing the department's role in safeguarding the public interest by administering the Food and Drug Law and the procedures used in its enforcement. Mr. Retzlaff touched upon the more recent developments such as chemicals in foods and the new insecticides.

NORTHEAST SECTION

Mr. Alf K. Berle, New Product Consultant and Staff Lecturer on Patent Law and Invention Management at the Sloan School of Industrial Management at Massachusetts Institute of Technology, was the guest speaker at the opening Fall meeting of the Northeast Section held on Thursday, October 2nd, 1952, at the Hotel Brunswick, Boston, Mass. Mr. Berle spoke on "Patent Management from the Point of View of the Individual in Industry."

PITTSBURGH SECTION

Four meetings were held during 1951-52. The business and dinner meeting was held at the Duquesne Brewery October 4, 1951, with Mr. Steinicke as host and speaker. He gave a very interesting talk on the brewing industry after which the group toured the brewery. On January 8, 1952, a meeting attended by thirty members was held to hear Dr. H. E. Longenecker of the University of Pittsburgh who gave a most informative talk on the Food Protection Committee. On September 12, 1952, a meeting was held at which Dr. Evan Wheaton of the American Can Company spoke on "Antibiotics in Food Preservation."

At the annual meeting, held on May 13, 1952, Dr. G. C. Jenson gave a discourse with movies on the manufacture of tin plate. At this meeting the election of officers for the coming year was held. Chairman for the year is Dr. I. J. Hutchings, H. J. Heinz Company, Pittsburgh 30, Pa. Vice-chairman is Mr. George Seagren of the Mellon Institute of Industrial Research, Pittsburgh, Pa.

ST. LOUIS SECTION

Activities of the past year included dinner meetings, a picnic meeting, and a joint meeting with the local section of the American Association of Cereal Chemists. All meetings were held in St. Louis. Speakers during the season included Dr. G. S. Bratton, who spoke on "Flour Enrichment"; Dr. William B. Kountz, "Nutrition of the Aged"; Dr. H. A. Hoffman, "Chromatography"; Mr. Curtis Joiner, "The Applications of the Food and Drug Law to Food Technology"; Mr. J. Blatterman, "Microorganisms in Water and Soft Drinks"; Dr. H. Schaefer, "Antibiotics in Feed Production"; and Mr. J. C. Dawson, "Sanitation in the Food Industry."

Officers elected for the 1952-53 season are Eugene Nay, Chairman; Boris Miller, Vice-Chairman; Barbara Hall, Secretary-treasurer; Nicolas Ferraez and Milton Albert, other members of the committee; and Charles Harrold, Councillor. Paul Aldrich is the membership chairman.

The Section has open dates on its 1952-53 program and will welcome correspondence with any speakers who may be in this area during the season. Please contact Mr. Boris Miller, Barry-Wehmiller Company, 4660 W. Florissant Avenue, St. Louis.

NEW YORK SECTION

New York Section Sets Dates. Beginning with a discussion on recent developments in the use of enzymes in the food industry, on October 15, the New York Section of IFT has scheduled a seven-meeting, and outing, program for 1952-53.

Dates of other meetings, to be held at the Brass Rail restaurant, 43 and Fifth Avenue, are: Thursday, Nov. 20, 1952; Thursday, Jan. 15, 1953; Wednesday, Feb. 18, 1953; Wednesday, Mar. 18, 1953; Wednesday, April 15, 1953; Wednesday, May 20, 1953.

At the November meeting, Dr. H. R. Kraybill, American Meat Institute, will discuss the important subject of antioxidants.

The January session will be an innovation. Several young food technologists in the New York area will participate in a "Meeting in Miniature." Each will present briefly significant results of important research on food problems.

Food technologists from other areas are cordially invited to attend the New York Section meetings.

OHIO VALLEY SECTION NEWS

On November 15, 1952, at the new Agricultural Laboratories Building of the Ohio State University, Columbus, Ohio, the Ohio Valley Section will hold the following afternoon and evening program:

1:00-2:00 Registration, Room 100

2:00-2:30 "Cooling and Holding Large Quantities of Food," A. R. Winter, Martha Lewis and H. H. Weiser. Departments of Poultry Science, Dietetics and Bacteriology, The Ohio State University.

2:20-2:40 "The Relations of Processing Methods to Color of Tomato Juice." W. A. Gould, Rees Davis, Donald Wilson, and H. D. Brown. Department of Horticulture, The Ohio State University.

2:40-3:00 "Exploratory Studies on the Processing of Beef by the Infusion of Antibiotics." V. R. Cahill, L. E. Kunkle, Herbert Goldberg,

(Continued on page 16)

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Conclusive Tests by Manufacturers of a Wide Variety of Products Prove Its Advantages in Flavor, Aroma and Economy

As a result of several years of research and development, Felton Chemical Company chemists have produced a new coffee flavor that has revolutionized the use of coffee in many products. Candy, ice cream and baked goods manufacturers have long been aware of the handicaps presented by the lack of stability of coffee flavor concentrates, and it was this problem which Felton tackled first. Literally hundreds of new chemicals were isolated in the search for proper ingredients, and at least fourteen new specific aromatics were developed.

Never before has all phases of such important matter are no distortion found in any of the products Study carefully the ingredients were listed as outlined in the Felton contributed to the most important Never before has by doing all phases of such important matter are

75 Times Stronger Than Coffee

Felcafé has been found to be at least 75 times stronger than coffee, and its economy is quickly obvious to any manufacturer. Thousands of batch tests have been made, not only by Felton, but by manufacturers using flavors, and based on the commercial conditions of manufacture in the candy, ice cream, dessert, beverage and extract fields. Felcafé has proven its record-breaking economy.

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Felton's unusual flavor is non-volatile, and its stability eliminates any worry about cooking off or freezing out. Neither does it oxidize or become rancid.

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Felcafé retains its full-bodied flavor in Hard Candy, Toffee, Caramels, Fudge, Soft Centers, Creams and Fondants, Marshmallows, Gum, Starch Jellies, Chocolate.

Ideal for Foods and Desserts

Popular coffee flavor can now be successfully applied to Ice Cream, Ices and Sherbets, Packaged Ice Cream Mixes, Puddings, Syrups, Beverage Concentrates, Gelatin, Pie Fillings, Cake Fillings, Icings, Toppings, Sandwich Fillings, Carbonated Beverages, Extracts.

Versatility of New Flavor for Pharmaceuticals

Coffee as a flavor for pharmaceuticals can be a big factor in the success of all kinds of products such as Pharmaceuticals, Lozenges, Troches, Vitamin Tablets, Cough Syrup, Elixirs.

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Tell us about the products in which you would like to use Felcafé. We will be happy to send you directions and liberal samples for testing.

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Regional Section News

(Continued from page 14)

H. H. Weiser, and F. E. Deatherage. Departments of Animal Science, Bacteriology, Agricultural Biochemistry. The Ohio State University and the Ohio Agricultural Experiment Station.

3:00-3:10 Intermission.

3:10-3:40 "Some Applications of Ion Exchange in the Dairy Industry." E. F. Almy, Department of Agricultural Biochemistry, The Ohio State University.

3:40-4:05 "Trends Toward the Use of Vegetable Fats in Dairy Products." Thomas Harman, Department of Dairy Technology, The Ohio State University.

4:05-4:35 Group inspection of the Agricultural Laboratories Building which houses the Departments of Dairy Technology and Agricultural Biochemistry.

4:35-5:00 Business Meeting

The Dinner will be held at the Faculty Club, Ohio State University at 5:45 P.M. Speaker for the occasion is Dr. Bernard E. Proctor, President, Institute of Food Technologists. Dinner reservations for members and their guests should be made with H. D. Brown, Department of Horticulture, The Ohio State University, Columbus 10, Ohio before the 14th of November. Fee for the dinner is $2.50 per plate.

The Agricultural Laboratories Building is between Stadium Drive and Lane Avenue on the campus west of the Olentangy River. There is plenty of parking space in the rear of the building.

PERSONNEL

JOHN H. NAIR of Thomas J. Lipton, Inc. was selected by the American Chemical Society council at the fall meeting in Atlantic City as one of the two candidates to be voted on in November by mail ballot for the high office of President-Elect of this distinguished and venerable society of American scientists. Members of the Institute who belong to the A.C.S. are thus accorded the opportunity this month to establish a precedent by electing a food chemist as President-Elect of the American Chemical Society. If elected John Nair would be the first chemist identified with the food industry to hold this important office and his election would not only reflect added professional prestige upon the Institute but also obtain recognition for the important contributions the membership is making to advances in food chemistry and per se to scientific knowledge. John Nair's diligent and conscientious work on behalf of the Institute—as founding member, as past chairman of the New York Section, as co-chairman of the 1951 Annual Meeting, and as a wheel-horse on many an Institute committee—is sound evidence on which to base the conclusion that if elected John Nair will fulfill his responsibilities ably, cheerfully, and with distinction. Balloting is to be accomplished by mail this month.

Z. I. KERTESZ, Professor of Chemistry, New York State Agricultural Experiment Station, Cornell University, Geneva, has been granted a leave of absence to accept a one-year appointment as Director of Food Research for the United Nations' Food and Agricultural Organization Technical Assistance Program in Ceylon. Among other activities Dr. Kertesz will coordinate the work of a team of F.A.O. food experts and advise the Ceylon Food Research and Nutrition Council on the establishment of a Food Research Institute. He will leave early in October for Rome, Italy, for briefing at F.A.O. Headquarters and proceed to Ceylon by the end of the month. The recognition that has come to Dr. Kertesz is eminently merited, and the best wishes of a host of friends—both within and outside the Institute—will accompany him and his family during his assignment overseas.

DR. PHILIP K. BATES, formerly of the Riker Laboratories, Inc., Los Angeles, recently appointed General Manager of Research of the Carnation Company, took over his new responsibilities on October 1. The Carnation Company has begun construction of their new research center and around May 1, 1953, after the completion of the new buildings, the research and development activities of the company will be centralized in the Los Angeles location. Dr. Bates will be established at the Wilshire Boulevard headquarters of the Carnation Company until the new research center is opened.

MR. VIRGIL O. WODICKA, assistant to the Scientific Director, Quartermaster Food and Container Institute for the Armed Forces, has been granted leave of absence to do graduate work at Rutgers University where he is a candidate for the doctorate. Dr. Walter Maclinn is his preceptor. Mr. Wodicka will conduct courses in food science in addition to pursuing graduate study.

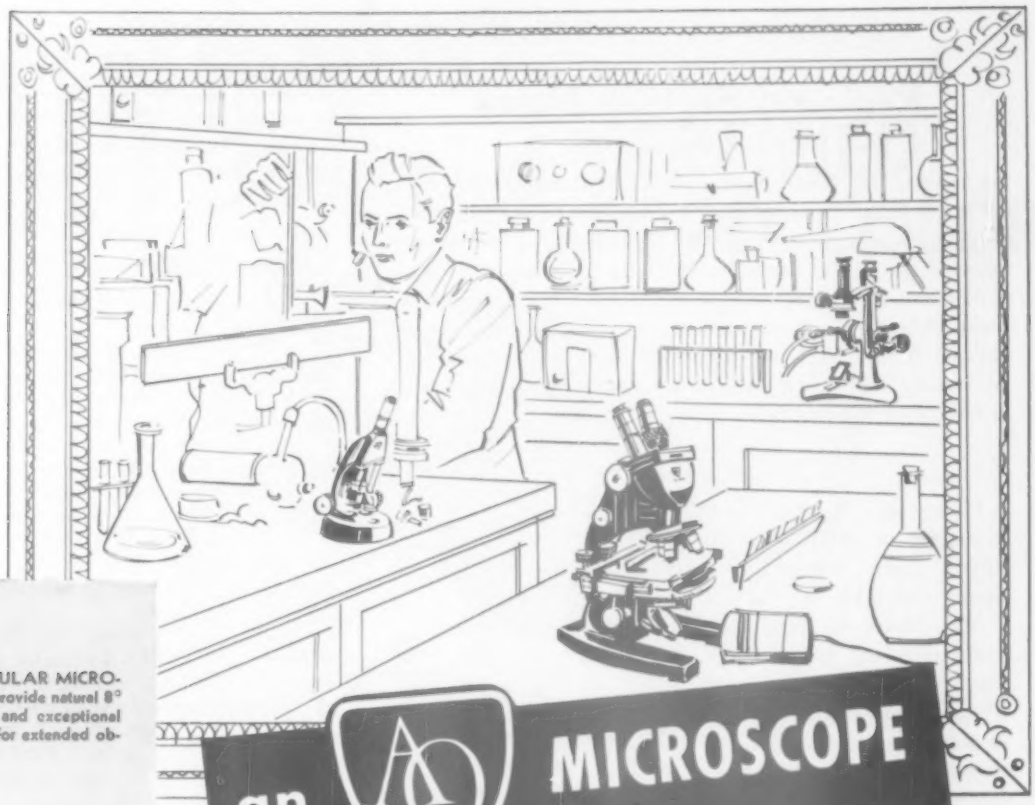
DR. L. E. CLIFCORN, Continental Can Company, was recently appointed to the Committee on Low Sodium-Diets, Food and Nutrition Board of the National Research Council.

NATHAN FOX has been appointed director of research for Chun King Sales, Inc., Duluth, processor of Oriental-American foods, according to Jeno F. Paulucci, president. Fox formerly was chief chemist for College Inn Food Products Company, Chicago. At Chun King he will direct the quality control program, research on current products and development of new products.

H. NED DRAUDT, of Kingan & Company's research laboratory has returned to The Ohio State University to work toward a doctorate in biochemistry under Dr. Fred Deatherage, chairman of the department of agricultural biochemistry. His field of special study will be a phase of meat color.

This summer DR. O. J. WORTHINGTON attended the Gordon Research Conference on Statistics in Laboratory Work, held under the auspices of the American Association for the Advancement of Science at New Hampton, New Hampshire. On his return trip through

(Continued on page 18)



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Regional Section News

(Continued from page 16)

the South, Dr. Worthington visited five food technology departments in colleges and universities to see what the other fellow is doing. At the University of Tennessee most of the work seemed to be of a pilot plant nature, performed in their fine new building. At nearby Virginia Polytechnic Institute the food processing investigations in the horticulture department were limited to laboratory work, the pilot plant stage being carried out in the processing plants.

OBITUARY

Lawrence Parker Abare, 46, Assistant Warehouse Manager of the Somerville Division, First National Stores Inc., Somerville, Mass., died suddenly on September 10th.

Mr. Abare received his Bachelor's Degree from the Massachusetts Institute of Technology in 1930. He came to the First National Stores in 1932 as a Food Chemist and organized the Laboratory, after which he became Factory Manager and then Assistant Warehouse Manager. He was a Founder Member of the Institute of Food Technologists and was well known and active in the Northeast Section.

OPEN LETTER TO ALL FOOD TECHNOLOGISTS

If you want to enjoy the time of your life, better plan now to attend the 13th Annual Food Technologists' Convention in Boston next June. The Northeast Section has a hard-working committee of 16 who have already laid the foundation for one of the pleasantest combinations of business and pleasure ever to be offered to the Institute. Outstanding speakers will discuss thought-provoking problems. Glamorous programs of fun and food are planned.

And, following the Convention, for all those who are so inclined, there can be treks to Cape Cod's sunny shores or New England's rock-ribbed North Shore, or to the verdant mountains of New Hampshire and Vermont. Start now making plans to be with us. Include the wife and children, too. We have plans for entertaining them while you're at the Convention trading new ideas, techniques and plans with your fellow members.

On behalf of the entire Northeast Section, a cordial welcome to you all. Should you want vacation ideas, feel free to call on us.

Be seein' of you in Boston—
Loren B. Sjoström
General Chairman

Books

Statistical Quality Control. Second Edition. By Eugene L. Grant. 557 pages. McGraw-Hill. New York, N. Y., 1952.

The author has provided a very apt description of this work. In the Preface to the first edition, he says, "This is a working manual. Its object is to explain simple but powerful statistical techniques that can be widely used in industry to reduce costs and improve product quality. The most effective use of these techniques depends upon their being understood by production and inspection supervisors, by engineers, and by management."

In the Preface to the second edition, he says:

"The most important changes from the first edition of this book are as follows:

"1. The chapters dealing with acceptance sampling by attributes have been considerably expanded and largely rewritten. . . .

"2. The chapter dealing with acceptance sampling by variables has been entirely rewritten. . . .

"3. The treatment of the cost aspects of quality decisions has been considerably expanded.

"4. Less extensive changes have been made in the remainder of the book, chiefly to introduce new material.

"5. The number of problems has been more than doubled. Answers are now given to about 30% of the problems with the thought that this may be helpful to those persons who use the book for home study.

"6. The master tables from 'Military Standard 105A—Sampling Procedures and Tables for Inspection by Attributes' have been included in an appendix. Two tables for use in variables sampling have also been included. . . ."

The first edition of Grant fulfilled the author's purpose very well and the book has long been a favorite with self-taught practitioners of statistical quality control and others with limited formal training in the field. It is very practical in its orientation, contains a wealth of illustrative material, and is quite understandably written.

The second edition, retaining the virtues of the first, has been brought up to date to early 1952. Although the new edition contains only 500 pages of textual material as opposed to 525 in the old one, the narrower margins in the newer edition have made it possible to pack in more information. The extent of this rearrangement is indicated by the fact that the first hundred pages of the old edition are carried over practically verbatim to form a little over 88 pages of the new edition. The discussion of probabilities has been strengthened and more problems introduced. The provision of answers to many problems throughout the text will be welcome to many food technologists who will want to use this book without a teacher.

Now that practically all new military specifications on foods are requiring sampling in accordance with Military Standard 105A, the inclusion of a good discussion of this Standard in Grant's book and of a generous selection of the tables in the Appendix will be welcome to the food technologists facing problems on statistical quality control for the first time. More advanced practitioners will be more interested in the discussion of the Shainin Lot Plot and of methods of inspection by variables.

Although the wider experience of industry in general with statistical quality control is reflected by the greater number of problems taken from industrial data rather than from the draw of chips from a bowl, it is unfortunate for the food technologist that applications to the food industry are still not numerous either in the text or in the problems. This is not too surprising in view

(Continued on page 20)

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WORLD'S LARGEST SUPPLIERS OF VANILLIN

Books

(Continued from page 18)

of the relative lateness of the food industry in adopting this tool of modern management.

Minor but welcome innovations in this edition are a list of the examples in the table of contents and a separate name index at the back.

For the research man who would like to use statistics in designing experiments, in finding the correlation between variables, and in determining the significance of his research findings, this is not the book; the techniques for these operations are not presented. For the man of imagination who is concerned with the control of quality, cost, or yield, this book is still in this reviewer's opinion the foundation stone.

VIRGIL O. WODICKA.

COLOR IN BUSINESS, SCIENCE, AND INDUSTRY, by Deane B. Judd, 401 pp., John Wiley & Sons, Inc., New York, Chapman & Hall Ltd., London (1952), $6.50. L. C. Catalog Card No. 52-5853.

For any one in the food industries with a problem in color measurement, this is the book. It is the only book in its field, it is authoritative, and it is up to date. In 400 pages one cannot tell all there is to know about practical colorimetry, but Dr. Judd, from his twenty years of experience in the Photometery and Colorimetry Section of the National Bureau of Standards, has successfully distilled out the essentials. It is a book for the beginner and for the expert. In 79 pages, Part I discusses Basic Facts essential for any real understanding of modern colorimetry; Part II, pages 80-296, discusses Tools and Techniques; Part III, pages 297-350 discusses the Physics and Psychophysics of Colorant Layers; pages 351-367 consist of useful tables; pages 368-384 of References; and 385-401 an Index.

In Part II, the average color worker in foods will find the most help. A 53-page discussion of uniform color scales and color tolerances, complete with formulas and diagrams, is worth the price of the book, as is the 54-page section on Color Standards, or the section on Colorimetry by difference. Spectrophotometry, Fundamental Standards in Colorimetry, Visual Colorimeters, Reproduction of Pictures in Color, and Color Languages are titles of the remaining sections of Part II.

The section on Color Standards discusses various methods of systematic sampling of the color solid; by colorant mixture systems, by color-mixture systems; and by color-appearance systems. It is noted that the Munsell system is preeminent for color specification and for teaching what is meant by uniform color space, also that this notation is recommended in American Standard Z58.7.3/15 (1951). (This is noted because wide use is made in some sections of the food industries of the Munsell notation.)

Colorimeters are discussed, both visual and photoelectric. The index is useful for locating descriptions or discussions of particular interest.

While it should not be inferred that many can read this book as they would a novel still, for so technical a subject, the author holds the interest. He has a dry humor that pops out every now and then to surprise the reader, or bring him quite back to earth and to his own very practical problem.

For any one with a problem in color measurement, this book should be within reach—not in the library, but on one's desk.

DOROTHY NICKERSON.

FOOD SCIENCE. A Symposium on Quality and Preservation of Foods. E. C. Bate-Smith and T. N. Norris (Editors). 319 pp. University Press, Cambridge, England, 1952. $8.00.

This book is a collection of lectures that were given in 1948 in a summer course in "Food Science" arranged by the University of Cambridge, England, in cooperation with the Low Temperature Research Station, an establishment of the Department of Scientific Research of Great Britain associated with the University. "Food Science" is defined in its broadest sense as a science that ranges over the whole biological vista, including a consideration of the nature of food, its composition and properties, its origin in the fundamental reactions of photosynthesis, food management, and food preservation.

The opening chapter of the book deals with the economics, supply and distribution of foods in the United Kingdom. The following chapters deal with the principal foodstuffs (meat, fish, eggs, fresh fruits and vegetables, potatoes, and cereals), the basic constituents of foods (proteins, mucopolysaccharides and mucoproteins, carbohydrates, fats), some aspects of quality in foods (physical and chemical bases of quality, structure of biological tissues, etc.), the microorganisms, the chemical mechanisms of spoilage, and the principles of food preservation with special emphasis on refrigeration. Only brief consideration is given to the relatively new field of sterilization of foods by radiations.

Lectures given in the summer on nutrition and milk and dairy products have been omitted from this collection of lectures, because excellent textbooks on these subjects are already available and inclusion of these topics would have meant curtailment of new material.

At the end of each chapter is a list of the literature references cited in the text. These literature references and the statistics presented in many of the tables are chiefly British in origin. However, a fair proportion of information derived from investigations made in other countries is also included, so that the book is not limited nationally in its scope.

The book concludes with an Appendix giving information about the organizations in the United Kingdom that are conducting research in the many fields of food science and the chief publications in which the results of such research are published. There is also an author index and a 5-page subject index.

Scholarly presentation of scientific facts, clarity of expression, good printing, excellent photographs, and self-explanatory tables and charts combine to make these lectures a most profitable reference source for information in the field of food science.

This volume should be included in all up-to-date libraries concerned with food technology.

BERNARD E. PROCTOR.

and for laboratory experiments. Our evidence leads us to believe that there is little change in eating quality in 1 day of storage at 33° F. (—.056° C.).

RESULTS FROM CHEMICAL ANALYSES

The chemical data in instances where considerable change occurred are reported in Figure 1. The figure and all discussion are on the per-pea basis. The data for harvest-day peas calculated on fresh-weight basis are listed below, however, for the reader who has use for this supplementary information.

Constituent	Quantity per 100 g. of fresh peas
Total sugars	7.4 g.
Reduced ascorbic acid	34.0 mg.
Thiamin chloride	137.0 μg.
Total solids	18.7 g.

Sugars. The peas lost 11 and 16% of their total sugars during the freezing and dehydrofreezing procedures, respectively. The pod peas stored at 33° F. (.056° C.) increased slightly in sugars during the 18 days. Other investigators *(1, 20)* have reported increase due to transfer of sugars from pods to peas. At 75° F. (23.9° C.) the pod peas lost sugar rapidly: 11, 32, 50, and 80% in 1, 2, 3, and 7 days, respectively. Several investigators *(1, 8, 9, 18)* have reported similar but, in general, larger changes in sugar content during pod storage in the range of these temperatures. Losses of sugar to the liquor during cooking were about 30%, for all lots except the starchy, low-sugar-content peas stored 7 days at 75° F. (23.9° C.), for which the loss was 12%.

Ascorbic acid. Frozen and dehydrofrozen peas lost 15 and 20% of their reduced ascorbic acid respectively during processing. The pod peas lost small amounts of this vitamin during storage at 33° F. (.056° C.), 13% in 18 days, but at 75° F. (23.9° C.) they lost 22% in 2 days and 50% in 7 days. Several investigators *(10, 14, 17, 19, 23)* have reported similar losses during pod storage. Most of the pod lots lost about 37% of this vitamin to the liquor during cooking, while the frozen and dehydrofrozen peas lost 41 and 46%, respectively, and the pod peas stored 7 days at 75° F. (23.9° C.), 20%. In no instance was there significant destruction of the vitamin during cooking.

Thiamin. The thiamin values were determined for selected storage periods only, since the longest periods showed no significant change. Also processing caused no significant loss. The original content was very low, 137 μg. per 100 g. of fresh peas, which seems to be typical of the variety *(5, 16)*. Cooking losses to the liquor, as with sugar and ascorbic acid, were high, amounting to about 20%; there was no significant destruction of thiamin during cooking.

Total solids. The harvest-day, uncooked peas contained 96 mg. total solids per pea (not included in the graph), and they lost 7% of their solids during freezing and 9% during dehydrofreezing. All of the stored pods except the lot stored 7 days at 75° F. (23.9° C.) had similar solids content, 96 to 102 mg. per pea. The latter increased from 102 to 132 mg. per pea between the third and seventh days at 75° F. Total solids content of cooked peas was not determined.

Influence of sodium bicarbonate in cooking water. Because the sodium bicarbonate added to the cooking water might influence ascorbic acid and thiamin content of the cooked peas, this phase of the procedure was investigated. In one test, duplicate lots of peas were cooked in unadjusted distilled water, pH 5.9, and in distilled water adjusted as in the main study to pH 8.0 (0.03 percent sodium bicarbonate). In another trial, a larger range of concentrations of the bicarbonate was used, 0.03, 0.06, 0.12, and 0.24 percents. None of these solutions significantly influenced rduced ascorbic acid or thiamin content of cooked peas or cooking liquors. Hewston et al. *(7)* have reported similar results.

COLOR AND RELATED RESULTS

Chlorophyll changes. Chlorophyll data for uncooked peas are not reported, because no significant degradation was observed in any of the samples. However, other changes occurred during storage of the pod peas, which led to progressive chlorophyll changes observed in the cooked samples. Figure 1 shows the percent total loss of chlorophyll and pheophytin of each cooked sample compared with the cooked fresh peas of harvest day. The figure also shows the conversion (percent) of chlorophyll to pheophytin in a given cooked sample. In the case of samples stored at 33° F. (.056° C.) for 18 days, considerably more than one-half of the chlorophyll was converted to pheophytin (after cooking) with little change in the sum of these two components. In the 75° F. (23.9° C.) samples, different results were obtained. The percent of conversion of chlorophyll to pheophytin remained almost constant but there were progressive losses of chlorophyll and/or pheophytin amounting to about 40% during the 7 days of storage at this temperature. The frozen peas lost a small amount of chlorophyll, a relatively small proportion of which was converted to pheophytin. Data on losses of chlorophyll and pheophytin from dehydrofrozen peas are not given, since complete extraction of these pigments was not obtained with the procedure used. Complete extraction of pigments is not necessary, however, for reliable estimation of degradation of chlorophyll to pheophytin and the latter data show that the percent conversion was similar to that for frozen peas.

pH changes. The pH of cooking liquors decreased (because more acid) with increase in storage time, and decreased more rapidly at 33° F. (.056° C.) than at 75° F. (23.9° C.) (Figure 1). Liquors from the processed peas were less acid than those for strictly fresh peas.

Reflectance changes. Since Eastmond *(4)* has reported the details of the reflectance data, conclusions only are given here. Yellowness of pod peas increased with storage time. There was little difference between the lots stored at the two temperatures during the first 3 days, but when both lots were stored for 7 days, the 75° F. (23.9° C.) peas were considerably more yellow than the 33° F. (.056° C.) lot. The latter continued to change slowly with additional storage time. Both lots of processed peas were less yellow than strictly fresh peas. Directional luminous reflectance (not included in graph) showed that increasing lightness tended to follow increasing yellowness.

Association of objective data and judges' scores. The relationship of the objective measurements to judges' color scores follow:

	Reflectance Yellowness	Luminance	pH
Correlation coefficient—objective values with scores	—0.94	—0.80	0.88
Standard error of estimating score from objective value	0.38	0.65	0.51

Yellowness was the best objective measurement of color change as regards degree of association with judges' color scores and error of estimating score from

the objective value. Association of chlorophyll data with scores was not calculated, because obviously neither total loss of chlorophyll and pheophytin nor conversion of chlorophyll to pheophytin was closely associated for all samples. The total loss was closely associated with scores for the 75° F. but not the 33° F. (.056° C.) peas, and conversion was closely associated for the 33° F. (.056° C.) but not the 75° F. (23.9° C.) peas. Although chlorophyll data did not provide an independent measurement, these and the pH data give some information about the nature of changes that produced the color changes observed by judges. The pH is closely associated with degradation except for the 75° F. (23.9° C.) peas, where other factors obscure the relationship; also it is closely associated with reflectance yellowness and color scores. Any further study of causes of deterioration of stored peas should attempt to explain the pH changes.

A question might be raised about the relationship of bicarbonate in cooking water in 1947 to color changes. It should be noted that color scores decreased at about the same rate in 1949, when bicarbonate was not added but the water was boiled to increase its pH.

SUMMARY

Quality changes in peas during pod storage up to 18 days at 33° F. (.056° C.) and up to 7 days at 75° F. (23.9° C.) and during freezing and dehydrofreezing of harvest day peas of the same lot are reported. Changes in total solids, total sugars, reduced ascorbic acid, thiamin, chlorophyll, pH of cook liquors, color as measured by reflectance, and judges' scores were measured.

1. *Processed Peas.* Processed peas were equal in eating quality to strictly fresh pod peas, and slightly better than those held 2 days at 33° F. (.056° C.) or 1 day at 75° F. (23.9° C.). Also, they were at least equal to strictly fresh peas in color and thiamin content. The losses of soluble constituents were 7 and 9% of total solids, 11 and 16% of total sugars, 15 and 20% of reduced ascorbic acid during freezing and dehydrofreezing respectively.
2. *Pod Storage at 33° F. (.056 C.).* Pod peas stored at 33° F. (.056° C.) deteriorated in eating quality slowly but progressively with time, the differences being statistically significant after 2 days. These pod peas changed little or none in solids, sugar, or thiamin, but lost about 12% of their ascorbic acid in 18 days.
3. *Pod Storage at 75° F. (23.9° C.).* These peas deteriorated in eating quality rapidly and progressively with time, the score difference being significant in 1 day. Thiamin content had not appreciably changed after 7 days. There was a 50% loss of sugar and 22% loss of ascorbic acid in 3 days, and in 7 days, an 80% loss of sugar and 50% loss of ascorbic acid. Solids increased markedly between the third and seventh days.
4. *Comparison of 33° F. (.056° C.) and 75° F. (23.9° C.) Storage.* In general, pod peas stored 1 day at 75° F. (23.9° C.) were equal in eating quality to those stored 6 or 7 days at 33° F. (.056° C.) and 3 days at 75° F. (23.9° C.) were equal to 14 days at 33° F.
5. *Data Related to Color.* Yellowness (as measured by reflectance) and pH were excellent indices of color changes as observed by judges. Neither relative nor total chlorophyll and/or pheophytin were found to be closely associated with color scores for all samples.
6. *Cooking Losses.* Losses of soluble constituents to the cooking liquors were quite large, 39% of sugars, 37% of ascorbic acid, and 25% of thiamin for most samples. There was no significant destruction of the vitamins during cooking.

Acknowledgment

The authors gratefully acknowledge the assistance of the following members of the staff of the Western Regional Research Laboratory: R. R. Legault in planning the experiment; C. C. Nimmo in procurement of the peas and handling of the stored peas; Helen L. Hanson, Soledad Payawal, and Alice M. Bittner in cooking and judging work and coordinating timing of chemical work; C. E. Hendel and Doris Taylor for ascorbic acid analyses; L. R. Leinbach and W. B. Dye for thiamin analyses; G. F. Bailey for chlorophyll analyses; E. J. Eastmond for reflectance measurements; and the taste panel for scoring the peas.

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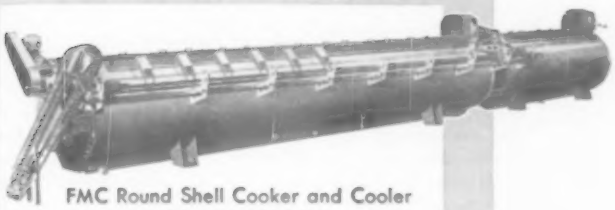

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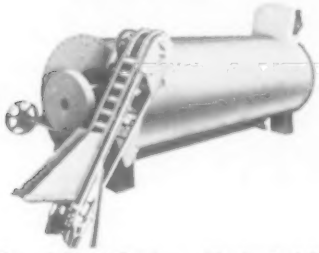

FMC Round Shell Cooker with single inlet

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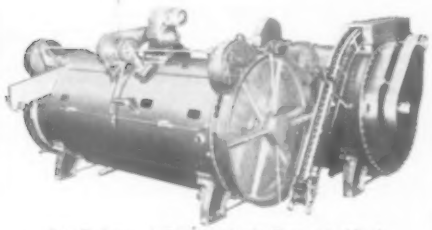

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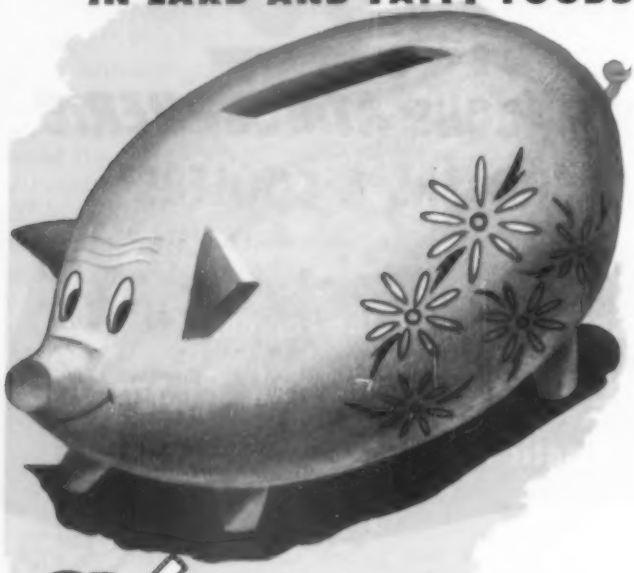

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Selected Abstracts*

ANALYTICAL METHODS

The colorimetric determination of alcohols.
REID, V. W., AND TRUELOVE, R. K. *Analyst, 77,* 325 (1952).
The use of ceric ammonium nitrate as a colorimetric reagent for the precise detn. of various alc. in dil. aq. soln. is described. In particular, the method of detg. alc. when present in certain glycol ethers is given. Some interferences have been investigated and methods of overcoming these are detailed.

Determination of traces of glycerine in the presence of sugars.
DRUCE, S. *Mfg. Chemist, 23,* 187-9 (1952).
A critical study is described of the periodic acid method for estg. traces of glycerin in the presence of sugars upon which is based a procedure also described for estg. glycerin in sirup mixts. There is disagreement with the A.O.A.C. as to efficiency. The sol. of sucrose, dextrose, levulose and glycerin in various solvents has been studied. A modified procedure has been defined for the estn. of glycerin in samples in which the sucrose has become inverted or reducing sugars are present. Five tables are given.

New methods of fat analysis.
KAUFMANN, H. P. *Fette U. Seifen, 52,* 713-21 (1950); *Fats, Oils Det., 9,* 5 (1952).
Free fatty acids may be identified by the color of their heavy metal salts after paper chromatography. The color of the metal salt may be enhanced by contrast dyeing of the paper with sodium alizarin sulfonate and other dyestuffs.

Analysis of commercial vanillin.
CABRERA, C. F. *Industr. Parfum., 6,* 337-40 (1951); *Brit. Abstracts, B II,* 276 (1952).
The m.p. of com. vanillin varies considerably and, as the m.p. of adulterated samples frequently fall within the same range, it is no criterion of adulteration. The majority of adulterants can be detected by the odor or color produced on treatment with aq. NaOH or $FeCl_3$, or H_2SO_4.

BIOLOGICAL SCIENCES

BIOCHEMISTRY

Metabolism.
Current Res. Sci. Nutr., June, 1952.
The seven body processes connected with metabolism are: 1. Intake of food or digestion. 2. Breaking down of food or digestion. 3. Getting rid of undigested food and body wastes or egestion, commonly called excretion. 4. Pick-up of digested nutrients to be distributed to body, called absorption. 5. Distribution of food and other materials to body called circulation. 6. Supplying oxygen to aid oxidation, and exhaling waste carbon dioxide from body, called respiration. 7. Use of materials furnished by digestion, absorption, and respiration to create heat, muscular, and mental energy, called oxidation; use of the materials to create cells and tissues, called growth.

Specificity of glucose oxidase (notatin).
KEILIN, D., AND HARTREE, E. F. *Biochem. J., 50,* 331-41 (1952).
The catalytic oxidation by notatin of β-glucose is much faster than that of α-glucose. Two samples of notatin (Y and Z), which were of equal catalytic activity in the oxidation of β-glucose, showed very different activities in the oxidation of α-glucose. Sample Z oxidized α-glucose about eight times faster than sample Y. Manometric study of the oxidation of α-glucose by these samples of notatin indicated that sample Z contained an addnl. component capable of catalysing mutarotation. This was confirmed by polarimetric study of the effect of the two samples of notatin on mutarotation of glucose under strictly anaerobic conditions, the expts. being carried out in an app. specially devised for this purpose. All eight-D-aldohexoses have been tested with notatin. If the rate of oxidation β-glucose = 100, those of the other sugars are: mannose = 0.98, altrose;

* These Selected Abstracts are made available to FOOD TECHNOLOGY through the cooperation of Associate Editor H. A. Campbell and the General Foods Corporation of New York, N. Y. The abbreviations found in these abstracts are similar to those used by Chemical Abstracts.

(Continued on page 26)

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Abstracts

(Continued from page 24)

0.16 and galactose; 0.14, while allose, gulose, idose and talose are not oxidized. Notatin can now be considered as a specific β-D-glucopyranose oxidase.

Biological catalysis of mutarotation of glucose.

KEILIN, D., AND HARTREE, E. F. *Biochem. J., 50,* 341-8 (1952).

Both culture filtrates of *Penicillium notatum* and exts. of mycelia, as well as the highly purified notatin (glucose oxidase) isolated from the former, in addn. to their property of catalysing the oxidation of glucose, also have the property of accelerating its mutarotation. The acceleration of mutarotation of glucose by these materials is due to the presence of a thermolabile and non-dialysable catalyst for which the name *mutarotase* is proposed.

Utilization and protein-sparing action of fructose in man.

ALBANESE, A. A., FELCH, W. C., HIGGONS, R. A., VESTAL, B. L., AND STEPHANSON, L. *Metabolism, 1,* 20-5 (1952).

It has been found that parenterally administered fructose is more rapidly utilized than glucose. Oral assays of diets high in fructose suggest that the rapid utilization of this hexose may be assocd. with an increased nitrogen retention. The practical implications of these observations are discussed.

Influence of potassium on tissue protein synthesis.

CANNON, P. R., FRAZIER, L. E., AND HUGHES, R. H. *Metabolism, 1,* 49-57 (1952).

Expts. designed to det. the influence of dietary potassium on the processes of tissue protein repletion indicated the essentiality of this intracellular cation in the reconstruction of tissue protein. Whereas in protein-depleted rats a repletion ration affording an adequate supply of calories, vitamins, amino acids, and salts caused excellent acceptance and effective recovery of lost wt., removal of potassium from the salt mixt. in the ration led to poor food consumption, failure to gain wt. adequately, development of cardiac lesions characteristic of potassium deficiency, and early death. However, addn. of small amts. of potassium chloride to the deficient ration enabled the animals quickly to achieve effective protein repletion. In other words, these expts. demonstrated a minimal daily need for potassium salts in the processes of protein repletion. They also revealed the inability of two protein hydrolysates of excellent amino acid compn. to accomplish effective protein repletion in the absence of potassium salts in the basal ration. This indicates a critically low level of potassium in these hydrolysates and a consequent need for potassium supplementation when they are to be used in parenteral alimentation. Otherwise, in a potassium-deficient subject they may be unable to manifest the nutritive potentialities of which they are actually capable.

Problems arising from the use of chemicals in food. "Inorganic residues in food."

PARSON, A. T. *Chem. and Ind.,* 384-8 (1952).

Discusses inorg. contamination of food due to: (1) residues from harvesting, (2) residues from spraying, (3) processing, (4) inorganic adjuncts, (5) packing.

The role of chemicals in foods.

NEWTON, R. C. *Canner, 114,* 14, 23-4, June 7, 1952.

Gives outline of methods for use in: 1. Acute Toxicity Studies. 2. Sub-Acute Toxicity Studies. 3. Chronic Toxicity Studies.

Fish as a source of food poisoning.

PIVNICK, H. *Canadian Fisherman 1951, 38,* 20, May, 1951; *World Fish. Abstracts, 3,* 43, January-February, 1952.

Fish-borne infections are very similar to those distributed by other types of food, such as milk, vegetables and meat. Such infections bring about an inflammation of the intestinal tract accompanied by nausea, diarrhea and high fever. In some instances the symptoms are very mild. The bacteria usually responsible for food-borne infections are those belonging to the Salmonella group. While the Salmonella bacteria are not usual in live fish in clean waters, they may be found in fish, and particularly in shellfish, taken from polluted waters. Actual cases of Salmonella infections from fisheries products are numerous.

Green pastures.

Ind. Bull. (A. D. Little), 288, 4, June, 1952.

Chlorophyllin prepns. have been used successfully for deodorizing, normal tissue repair, and relief of itching in wounds, skin infections, and burns without harmful side effects. Some authorities believe that it may reduce the healing time of burns by as much as 50%. The elimination of body odors by taking chlorophyll tablets internally still remains a much-debated subject.

Plant cancer.

BRAUN, A. C. *Sci. American, 186,* 66-72, June, 1952.

The tumerous growth of plants called crown-gall is analogous to malignant animal tumors. It is described how this plant cancer is used as a valuable tool for the study of abnormal growth in cells. Studies indicated that the initiation of the crown-gall tumor depends upon two factors: 1) a normal component produced by the cells during healing, and 2) a tumor-inducing principle produced by bacteria.

NUTRITION

Fat persons eat no more fat than normals do.

Science News Letter, 61, 262 (1952).

A study of 125 grown women, some very fat and some normal in wt., at the Harvard School of Public Health has shown that both groups choose from 35% to 40% of their calories as fat rather than the 25% considered normal. The very fat women, again contrary to what might be expected, did not eat a larger proportion of starches and sugars than the normal wt. women.

Tests show no antibiotic growth response in germ-free poultry.

Feedstuffs, 24, 1, June 14, 1952.

Preliminary results with germ-free birds fed antibiotics show that there was no growth response. In contrast, birds housed under conventional non-aseptic conditions did show growth responses. This would appear to substantiate the theory that antibiotics act through the medium of the intestinal flows.

A comparison of B_{12} fish solubles and whey in the growth of chicks.

FULLER, H. L., CARRICK, C. W., AND HAUGE, S. M. *Poultry Sci., 31,* 473-8 (1952).

3% fish solubles produced a greater growth response than 3 mcg. of vitamin B_{12} per 100 gm. of ration, while the B_{12} was more effective than 4% dried whey. Wilson's Liver Fraction "L" at a level of 2% was slightly more effective than 1.5 mcg. % of vitamin B_{12} in one trial.

Chickens make protein.

Science News Letter, 61, 251 (1952).

By tagging very dilute sulfuric acid with radioactive sulfur and injecting it into chickens it has been found that chickens manufacture the amino acid cystine. The radioactive sulfur was found in the eggs laid by these hens. Methionine, another sulfur-contg. amino acid did not contain the radioactive sulfur, and must therefore, be supplied by diet. This marks the first time that an animal has been shown to convert inorganic sulfur into protein. The work was done at the Dept. of Agriculture, Beltsville, Md.

Feed spuds to sheep for more and thicker wool.

Science News Letter, 61, 262 (1952).

Up to nearly one-fourth as much more wool as is now obtained can be taken from sheep fed a urea supplement and potatoes. The diameter of the wool fiber is also increased by 6%. The urea supplies nitrogen to an otherwise low-protein diet. The carbohydrate is necessary for making better use of the urea. The min. amt. of starch found to be good in the pen studies was a little over 3 ounces per day.

(Continued on page 28)

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Abstracts

(Continued from page 26)

Nutritive values of fruit and fruit juices.

MAGEE, H. E. *Food Manuf., 27,* 135 (1952).

Aside from the ordinary nutritive value of fruit and fruit juices there is value for treatment of diseases. It is believed that the distinctive feature about fruit is its high content of potassium relative to sodium. This is an important factor for the retention of calcium in the body.

Effect of protein level and penicillin on growth and intestinal flora of chickens.

ANDERSON, G. W., CUNNINGHAM, J. D., AND SLINGER, S. J. *J. Nutrition, 47,* 175-89 (1952).

Penicillin caused an increase in wt. and improvement in feed efficiency of chickens fed diets contg. 17, 20, 23 and 26% protein. While penicillin did not appear to change the protein requirement, the evidence suggests that the antibiotic enhanced protein utilization. A considerable reduction in the pH of the cecal contents of chickens resulted from the addn. of penicillin to diets contg. 17, 20, 23 and 26% protein. The alterations in pH appeared to be assocd. with the increase in numbers of lactobacillus, aciduric, anaerobic and microserphilic, aerobic and coliform types of organisms. The increase in coliforms was due to the presence of an atypical strain of *E. coli.* Enterococci counts were reduced by the addn. of penicillin, the reduction being similar at all levels of protein. Penicillin effected a marked increase in the size of the ceca with all levels of protein. With diets contg. levels of protein up to 23% a relatively close correlation was noted between increased growth of the birds and elevation in the numbers of certain microorganisms. It is suggested that the increase in numbers of these microorganisms or the resultant increase in the size of the ceca may be factors in explaining the mechanism of growth response to the antibiotic. On the other hand, the decrease in pH may cause increased activity of the intestinal villi or more complete digestion, and thus play a role in the growth response mechanism.

Surface active agents as growth stimulators in chick rations.

ELY, C. M. *Feedstuffs, 24,* 24. April 19, 1952.

A total of 108 exptl. groups (3500 chicks) were fed various growth stimulants including surfactants, antibiotics, vitamin B_{12} and arsenicals in all types of basal diets. Positive growth responses were obtained in 60 of the 63 expts. in which surfactants were fed. Of the types used, lauryl ethylene oxide condensate, sodium ethylene diamine tetracetis and quaternary ammonium compds. and sodium alkyl aryl sulfonate were effective. Two theories explaining the growth responses are: (1) selective inhibition of non-coli-aerogenes bacteria in the intestine and (2) more rapid assimilation of nutrients from intestines due to wetting properties of surfactants.

Salt additions to chick rations.

HEUSER, G. F. *Poultry Sci., 31,* 85-8 (1952).

A small amt. of added salt improved the growth of S.C.W.L. chicks to eight weeks of age. The total min. salt requirement in this expt., was approx. .65%. Increased amts. of salt increased water intake and raised the moisture content of the droppings. Considering all factors for the representative chick ration used in this expt. the addn. of ¼% of salt was sufficient.

Diet low in salts and resistance to vitamin deficiencies in the rat.

BORGATTI, G., AND JASONNI, D. *Boll. Soc. ital. Biol. sper., 26,* 1569-72 (1950); *Nutrition Abstracts Revs., 21,* 592 (1952).

Rats from 2 to 4 months old were maintained on a diet solely of wheat or rice starch, olive oil and purified casein. Some received also salts or vitamins or both. Those deprived of both lived longer than those deprived only of one, particularly the older rats.

Humidity extremes affect vitamin needs.

Science News Letter, 61, 269 (1952).

Expts. with rats indicate that humidity conditions affect vitamin requirements. When young white rats were kept in a dry air enviroment their paws became dry and scaly, whether they had a complete or a vitamin-deficient diet. The rats fed all the vitamins, however, recovered from their condition, while those deprived of vitamins did not. In very moist environments, relative humidity at 95%, rats on the vitamin-deficient diet developed a reddish pigment which stained the fur on the head and face so that it had a blood-caked appearance. The adequately fed rats were not affected this way. The studies show the need for standard humidity conditions in diet or vitamin studies on rats.

Age changes in relation to the ingestion of milk, water, coffee, and sugar solutions.

MCCAY, C. M., LOVELACE, F., SPERLING, G., BARNES, L. L., LIU, C. H., SMITH, C. A. H., AND SAXTON, J. A. *J. Gerontology, 7,* 161-72 (1952).

In order to det. the effect of various diets upon the life span, 4 groups of rats were placed on different regimes shortly after weaning. One group was fed upon pasteurized cow's milk supplemented with traces of iodine, iron, copper, manganese, and cod liver oil. A second group was induced to ingest large amts. of fluids by allowing them to drink only 10% sugar soln. A third group was given only coffee and a fourth group only water to drink. The last 3 groups received an adequate mixed stock diet with sugar added to the diets of the last 2 groups. The growth for all groups was similar. No differences in the total life span of the 4 groups were found, although more x-ray evidence of calcification was found in the group consuming milk alone than in the other groups.

Monozygotic twin beef cattle in nutrition research.

WINCHESTER, C. F. *Science, 116,* 3 (1952).

Geneticists have estd. that, in nutrition studies a pair of identical twin calves will yield data equivalent to that otherwise obtainable only with a herd of 40 or more, less closely related, individuals. Because both members of a monozygotic twin pair possess the same inherited characteristics, they respond in the same way to a given nutritional or environmental regimen. One member can thus be subjected to exptl. treatment and the other used as a control animal without complication caused by different inherited characteristics. Although the growth studies have been in progress less than three years, they already suggest that the loss of efficiency in the conversion of feed materials and the difficulty exhibited by growing animals in recovering from the effects of interrupted growth under range conditions, originate in protein, mineral, or vitamin A deficiencies rather than in a deficiency of feed energy.

ENGINEERING AND PLANT EQUIPMENT

Galvanic corrosion.

REICHARD, E. C. *Chem. Eng. Progress, 48,* 269-71 (1952).

Described are eight rules, with examples, on how to handle problems involving galvanic corrosion—two different metals in contact.

Low pressures prevent corrosion from chemicals.

Science News Letter, 61, 345 (1952).

When liquids are concd. at low pressures and temps. their corrosion rate on the still is reduced materially. By using low pressures, water can be driven from a liquid at lower temps. Since many chems. are less active when cold, corrosion, and in many cases scale formation, can be cut.

Thermocouple thermal error.

RIZIKA, J. W., AND ROHSENOW, W. M. *Ind. Eng. Chem., 44,* 1168-71 (1952).

A thermocouple can measure only the temp. of its measuring junction and often errors caused by conduction of heat down the thermocouple wire and subsequent loss to the environment may cause the junction temp. to differ greatly from the temp. of the substance being measured. An analysis is presented resulting in a chart soln. which enables a more accurate detn. of the temp. of the substance or fluid being measured, such as is often necessary in research work and industrial applications.

Rough-and-ready statistical tests.

WALLIS, W. A. *Ind. Qual. Control, 8,* 35-40, March, 1952.

Discusses "Quickie" tests for difference.

(Continued on page 30)

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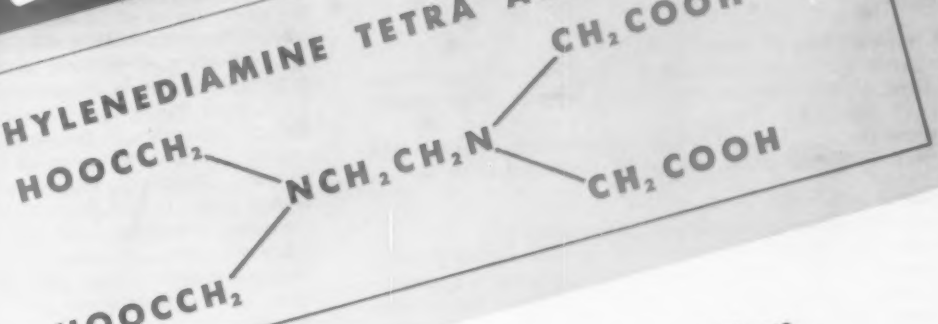

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Abstracts

(Continued from page 28)

FOOD AND FOOD TECHNOLOGY

Presenting the case for soluble coffee.

HARRISON, G. *Tea & Coffee Trade J., 102,* 16-17, April, 1952.

Sol. coffee now accounts for between 12 and 17% of the total coffee vol.

Grain is food—keep it clean.

Prepared with cooperation of FDA, Dept. of Agriculture, U. S. Dept. of Interior, Fish and Wildlife Service. *Mod. Sanitation, 4,* 24, June, 1952.

Suggestions are given on how to exclude birds, trap rats and mice, poison rats, rat proof, gas rat burrows, and clean up.

Fluoridated salt next.

Science News Letter, 61, 261 (1952).

Studies with hamsters point to the possible use of fluorine contg. salt as an alternative to fluoridation of water for prevention of dental caries. Among 16 groups of hamsters fed on high sugar diets there were striking differences in the no. of cavities in hamsters receiving ordinary salt and those fed the fluoridated salt. The latter group had very few cavities. Advantages of fluoridated salt would be the individual choice as to its use, as well as the prevention of excessive fluorine intake from water in persons who consume large amts. of water.

Seizure of food packaged in chemically treated wrappers.

Food Drug Cosm. Law Repts., 2, April 7, 1952.

Transparent food wrappers treated with dehydroacetic acid to prevent the growth of mold on the food are toxic, and food so wrapped is adulterated.

Science and the sense of smell.

Mfg. Chemist, 23, 3 (1952).

Prof. E. D. Adrian, neurologist and president of the Royal Society, thinks there are differences in the reaction of the olfactory organ to the different kinds of mol. with distinctive smells. The differences in the general distribution of excitation over the olfactory organ has the most influence upon discrimination between particular odors. Different receptors vary slightly but noticeably in their response to smells. Since these receptors are not evenly distributed, slightly water-sol. substances have more effect on the anterior parts of the organ, and substances that are sol. in oil affect the posterior parts most strongly.

Rice.

Rice J. (Annual), (1952).

Summaries of Rice Research over the past year are reported by the regional laboratories. These summaries include: Frozen Cooked White Rice, Canned Rice, Expanded Rice Product, Quick-Cooking Rice, Lipase in Rice Bran, Moisture Equilibrium Studies, Rice Bran Oil, Milling Studies and others.

Rice: appraisal of its nutritive value.

HOOVER, A. A. *Agriculturist, 107,* 3-8 (1951); *Brit. Abstracts, B III,* 221 (1952).

The salient biochem. and nutritional aspects are reviewed.

The influence of dried whey on cake quality.

HANNING, F., AND DE GOUMOIS, J. *Cereal Chem., 29,* 176-89 (1952).

Cakes contg. 20 to 40% fat and 100% sugar were prepd. with and without the addn. of 15% dried edible whey. The effect of whey was to give a more tender, soft, moist crumb, as well as improved flavor, browning and keeping quality.

Frozen milk.

BELL, R. W., AND MUCHA, T. J. *Refri. Eng., 60,* 606-07 (1952).

The temp. range for storing frozen milk and its concentrate up to approx. 45% solids content without the early development of flakiness begins below —8° F. and extends to below —17° F. Data presented indicate that the storage temp. should be lower than —10° F. but need not be lower than —20° F. This is a narrow temp. range above which neither milk nor its concentrate should be stored if prolonged preservation of a satisfactory body is desired and below which little addnl. stability is to be attained.

Chemical and physical properties of fish and shell fish protein.

Com. Fisheries Rev., 14, 20, March, 1952.

Factors affecting the quantity of drip are being studied. Experience gained so far has indicated that under similar thawing conditions: (1) the amt. of water released from fillets of the same species of fish varies from fillet to fillet; (2) spoiled fillets release more water than fresh ones; (3) the amt. of water released will vary from one species of fish to another; (4) there is little difference in the amt. of water released from large and from small Pacific oysters; and (5) within certain limits, there is little difference in the amt. of water released from thawed oysters which were frozen at different rates. (These are preliminary results and, must await further verification). Further studies indicate that the amt. of water released under similar controlled conditions from the thawed head portions of frozen fillets was not significantly different from the thawed tail portion of the same fillets. The results were an av. of 2.8% water from the head portion and 3.3% water (or "drip") from the tail portion.

The chemistry of tea fermentation.

ROBERTS, E. A. H. *J. Sci. Food Agric., 3,* 193-8 (1952).

In this review the nature of the enzyme and substrates taking part in fermentation are discussed and an outline of present-day views of the phys. mechanism of the process and of the chem. changes occurring are given.

Food emulsifiers . . . bring new highs in uniformity. 1. Four types evaluated.

PRATT, C. D., AND HAYS, W. W. *Food Eng., 24,* 109-12, May, 1952.

The emulsifiers are classified as follows: 1. Partial fatty acid esters of glycerol (commonly called mono- and diglycerides) made by reacting either fatty acids or triglycerides with glycerol. 2. Partial fatty acid esters or sorbitan, made by reacting either fatty acids or triglycerides with sorbitol. 3. Polyoxyethylene derivs. of the sorbitan partial esters. 4. Polyoxythylene derivs. of the fatty acids.

Recent developments in the preservation of pharmaceuticals.

SOKOL, H. *Drug Standards, 20,* 89-106 (1952).

The necessity for including preservatives in a wide variety of pharmaceutical prepns. has been indicated and a listing of the most important agents of this type has been given. The characteristics of an ideal pharmaceutical preservative as originally presented by Gershenfeld and Perlstein have been reviewed, and factors have been discussed regarding their proposal of the esters of parahydroxybenzoic acid as the agents most closely approaching the ideal preservative. Recent exptl. data on the anti-fungal and antibacterial activities of these esters have been presented, as well as a comparison between them and several of the other more popular preservatives. Further, new data on the acute and chronic toxicities of these esters have been discussed and the results of irritation studies in animals and humans described. Finally, the general aspects of the metabolism and fate of these esters of parahydroxybenzoic acid have been indicated.

Recovery of essences in fruit processing.

Glass Packer, 31, 382-3 (1952).

Fruit essences contg. aroma and flavor can be recovered during processing of fruit juice into concentrate and from vacuum pans during manuf. of preserves. The aroma is recovered by condensing the vapor from the jam kettle and concg. it by fractionization into a volume one-thousandth that of jam. The resulting product, a clear colorless liquid, is known as essence or volatile fruit concentrate. This may also find use in other foods such as ice cream, candy, ices, syrups, beverages, etc.

Breakdown of pectic substances by a new enzyme from Neurospora.

ROBOZ, E., BARRATT, R. W., AND TATUM, E. L. *J. Biol. Chem., 195,* 459-71 (1952).

An extracellular enzyme produced by *Neurospora crassa* rapidly reduces the viscosity of pectic acid and pectin and hy-

drolyzes uronide linkages. This enzyme, pectin depolymerase, differs from polygalacturonase in pH optimum, pH stability, and the nature of the end-products. More than 50% of the pectic acid attacked by depolymerase is converted to a low mol. wt. polyuronide. The low mol. wt. polyuronide has been isolated and found to be at least 90% homogeneous by electrophoretic analysis. The mol. wt. calcd. from electrophoretic data is about 4000, while that from end-group detns. is about 1300 or a multiple thereof. The evidence suggests that the polyuronide produced from pectic acid by depolymerase represents a basic unit of the pectin mol.

Polymethylgalacturonase, an enzyme causing the glycosidic hydrolysis of esterified pectic substances.

SEEGMILLER, C. G., AND JANSEN, E. F. *J. Biol. Chem., 195,* 327-36 (1952).

From a com. enzyme product there has been extd. a pectic enzyme, polymethylgalacturonase, which attacks the glycosidic polyguronide bonds of pectin from citrus fruit, raspberry and apple. Some characterizations are: optimum pH around 6; cannot product galacturonic acid, unable to hydrolyze more than 26% of available uronide bonds of pectin or more than 17% of those of citrus methyl glycoside of polygalacturonic methyl ester.

The reactive groups of gelatin.

Brit. Gelatin Glue Res. Assoc. Abstracts, 3, 1-6, May, 1952.

An up-to-date literature review of the various reaction groups in gelatin and of the most important reactions in prepg. modified gelatins.

Seaweed extractives.

STOLOFF, L. S. *Food Eng., 24,* 114-16, May, 1952.

Uses are discussed for refined hydrocolloid now being prepd. from sea-plants. Particularly suitable for gelling, binding, bodying, thickening, suspending, stabilizing and pptg. purposes. They are standardized for specific-uses by proper selection of raw stocks, controlled refining procedures, and final blending in accordance with lab. tests.

INDUSTRIAL CHEMISTRY

Pegging research costs.

Chem. Week, 70, 31, June 7, 1952.

A just-completed Defense Department survey points up the cost of researchers in government and industry. Results encompassing the broad field of research, aren't easily applied to specific situations. A more detailed industry-by-industry survey of researcher costs is now in the making.

The testing and use of fungicided paints in food processing plants.

RICHARDSON, J. H., AND DEL GIUDICE, V. J. *Mod. Sanitation, 4,* 32, April, 1952.

Requirements for a fungicide to be incorporated in paint were best met by solubilized copper-8-quinolinolate (sold by Scientific Oil Co., Chicago as "Cumilate"). Details of plant tests are given.

Electrostatic separators may help make Tennessee plant "cleanest corn mill" in the industry.

Am. Miller, 80, 26-7, April, 1952.

Quaker Oats uses electrostatic separators successfully in new Tennessee plant to remove insect and rodent pellet contamination from corn. The new method is still used in conjunction with older cleaning methods. The company plans to lease units to other millers in order to increase purity of edible milled products.

ORGANIC CHEMISTRY

Dilatometric investigations of fats. VI. Melting dilation as a function of chain length in fatty acids and their glyceryl esters.

SINGLETON, W. S., AND GROS, A. T. *J. Am. Oil Chemists Soc., 29,* 149 (1952).

Melting dilations have been detd. for the even-numbered, satd. n-fatty acids in the series lauric through stearic, and some of their glyceryl esters. These data have been correlated with

(Continued on page 32)

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Abstracts

(Continued from page 31)

data obtained previously to det. the relationship between melting dilation and the effective chain length of these compds. The melting dilations of the mono-, di-, and triglyceryl esters of a fatty acid were found to be proportional to the acid residue content of each compd. The melting dilation of a monoglyceride was one-half that of the diglyceride and one-third that of the triglyceride of the same fatty acid. The increment of melting dilation of the fatty acids and glyceryl esters increased regularly with each addn. of two methylene groups, with the end group components exerting a constant effect on the volume change. Equations were developed for calcg. the melting dilation of the n-fatty acids and their glycerides as a function of chain length of the fatty acid radical. The melting dilations of those compds. which are unsatd. or have less than 10 carbon atoms, cannot be calcd. by these equations.

PHYSICAL RESEARCH

Effect of electrolytes on the viscosity of potato starch pastes.

NUTTING, G. C. *J. Colloid Sci., 7,* 128-39 (1952).

Flow times of potato starch pastes were measured in a single Ostwald viscosimeter made of pyrex glass. Concns. were 0.4% and 1% and measurements were made at 30 and 90° C. Starches were derived by cation exchange from a high grade com. potato starch.

PACKAGING

Dupont announces neoprene paper.

Frosted Food Field 1951. *World Fish Abstracts, 3,* 17, January-February, 1952.

Double-walled insulated bags for frozen foods, which will not break when water condenses on the packages and soaks the paper, may be one end-result of a research project just completed by E. K. DuPont de Nemours & Co. DuPont has developed what is described as a new and economical way to add the synthetic rubber, neoprene, to paper. Instead of coating or satg. the finished paper, as in older methods, the neoprene is now added latex form to the pulp just before it is made into paper. The result is a new family of low-cost specialty papers made directly on the paper machine. Outstanding advantages claimed for the new papers are higher wet strength and chem. resistance, and all-around improvement in phys. properties. In the industrial field, neoprene-treated paper has already undergone successful field trials in such applications as multiwall bag paper, wrapping paper and box board.

PATENTS (U. S. A.)

Citrus juice products having stabilized cloud and process for making the same.

STEVENS, J. W., AND PRITCHETT, D. E. Assignors to Sunkist Growers, Inc. 2,599,519, June 3, 1952.

A method of improving the natural cloud of a citrus juice product which comprises incorporating in the juice product in soln. therein, as a minor constituent thereof, insufficient to materially increase the final beverage viscosity, a water sol. gum of high mannogalactan content, whereby a relatively high permanence of stability of suspension of the natural cloud producing substances present in juice product is imparted thereto.

Process of treating tomato juice.

HAVENS, R. A., ORR, B. E., PITTS, P. R., AND CUNNINGHAM, R. W. Assignors to Havens. 2,598,374, May 27, 1952.

The process of treating tomato juice which comprises; generating supersonic sound waves of sufficient power to penetrate tomato juice for an appreciable distance and thereafter subjecting all portions of a mass of tomato juice to supersonic sound waves with an amplitude sufficient to break a substantial portion of the cell structure of tomato juice and release the contents of the broken cells, at least partially to gelatinize the treated juice.

Process for the sterilization of salted foods and materials.

RAHN, O. 2,594,213, April 22, 1952.

A process for the canning of salted foods and materials which consists in adding thereto hydrochloric acid to insure an acid condition with a pH under 4.5, sealing it within a can, sterilizing by heat below the temps. ordinarily employed in pressure canning, and subsequently adding aseptically an equivalent amt. of sodium hydroxide to combine with the hydrochloric acid within the scaled can so as to form common salt (sodium chloride) in palatable amts. and holding the can off the market for several days so that the alkali will diffuse uniformly to create the salt intimately in the cell structure, whereby the foods and materials are sterilized in an acid condition and utilized in a salted condition.

Tablet jellies and process of preparing same.

BAKER, G. L., AND HISTON, M. O. Assignors to Chivers & Sons, Ltd. 2,594,439, April 29, 1952.

A concd. jelly compn. in the form of a solid aq. gel which will form a greater volume of an edible dessert jelly on dissolution in hot water following by cooling gel comprising pectin in completely dispersed state the methoxyl content of which pectin is within the range of from 1 8.5% based on 100% calcium pectate, an edible acid, a water sol. edible salt of a polyvalent metal and a sweetening agent selected from the group consisting of sugars, polyhydric alc. derived from sugars by reduction, glycerine and edible sugar-contg. compds. the sol. solids content of gel being within the range of from 68-80% by wt.

WORLD FISH PRODUCTION

The herring family, which makes up the largest proportion of fish caught in the sea, is being given a close run by fish caught in fresh and brackish waters, according to a study of world fish production by the Food and Agriculture Organization's Fisheries Division.

Of an estimated 25,000,000 tons of fish produced annually by the world's fisheries, herring and similar species make up 21% of the total, while fresh and brackish-water fish are a close second with 19%, the study reveals. Cod, hake, and similar species comprise 14% of the total, and crustaceans and mollusks 8%. Salmon, tuna, and flat fishes are represented by lesser percentages.

If the total annual world catch were divided among the world population, the FAO study estimates that the availability of fish per person would be about 27 pounds a year. But this figure does not indicate how much is actually consumed because a considerable part of the total weight is cut away during cleaning, and a certain quantity is converted into oil and meal which is not for human consumption. Actually, only about 20% of the world catch reaches the table.

Asia, excluding Russia, is the leading fish-producing region of the world, yielding 48% of the total. Europe follows with 24%, and North America and South America combined, with 17%.

The outlook for increased fish production appears to be promising, for the FAO study reports that many countries are adding, or planning to add, mechanized craft to the fishing fleets to fish in areas farther from port and save travel time. Moreover, the report adds, improvements in fishing gear and equipment are being made in many underdeveloped as well as developed countries. [*Com. Fisheries Review,* **13** (12) 22 (1951) December].

PORTUGAL ESTABLISHES AN INSTITUTE OF MARINE BIOLOGY

Fisheries research in Portugal has been carried on since 1919 by a Marine Biological Station (Estaçao de Biologia Maritima) in cooperation with the Vasco da Gama Aquarium under the name "Aquário Vasco da Gama—Estaçao de Biologia Maritima," in Lisbon. To enlarge its technical and scientific program, the Portuguese Government recently separated it from the Aquarium, and today, it operates as an independent institution called Institute of Marine Biology (Instituto de Biologia Maritima) with its own headquarters in Lisbon. The Institute is directed by an Administrative Council whose President is also the Director of Investigations. There are two permanent posts for investigators.

Although the Vasco da Gama Aquarium is now an independent educational organization, it plans to maintain close technical collaboration with the Institute. The Aquarium is being modernized.

Portugal, a traditional fishing country, has 800 kilometers of coast, is rich in fisheries resources, and indeed, fisheries are second only to agriculture in the economy.

The newly organized Institute will certainly be an important factor in the further scientific development of the Portuguese fisheries resources. [From *FAO Fisheries Bull.*, **4** (4) 32 (1951) July-August].

FISHERIES RESEARCH IN YUGOSLAVIA

Along the Yugoslav coast are several oceanographic and sea fisheries research stations devoted to the investigation of the fauna and flora of the Adriatic Sea. Studies are made, not only from the theoretical point of view, but also from the point of view of the practical needs of Yugoslav fisheries. Biological experiments and technological experiments, including the mechanization of fishing craft and improvement of the gear of the country, are carried out. Of particular importance to Yugoslav fisheries is the conservation of its resources. Thus the stations are engaged in surveying and charting winter fishing grounds of blue fish, sardines, mackerels, and tuna; in studying regulatory measures to avoid overfishing; and in studying types of gear to avoid the use of harmful gear.

The stations are under the supervision of the Institute for Oceanography and Fisheries in Split. The Institute, founded in 1930 in Zagreb by the Yugoslav Academy of Science and Art, has three sections: physiological, biological, and ichthyological. It also offers practical fisheries biology courses for university students and publishes scientific papers in its ACTA *Adriatica*.

A station in Rovinj, Istria, rebuilt in 1947, is devoted to research in the northern part of the Adriatic while a station at Dubrovnik, Ragusa, built in 1946, deals with problems of the southern Adriatic. A station in Ston Mali, near Dubrovnik, is engaged in scientific investigations and culture of oysters, crabs, and sponges.

Fresh water fisheries research is done mainly at the Institute for Fresh Water Fisheries in Zagreb, Croatia, and a hydro-biological station on Lake Ohrid. [From *FAO Fisheries Bull.*, **4** (4) 33 (1951) July-August].

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Atomic energy is being used by the National Sanitation Foundation to show up invisible dirt and bacteria remaining on clothing and dishes after washing. It is expected that the new development will be useful to manufacturers and consumers in determining which washing process, detergent, or machines do the best job under given conditions, and which surfaces are easier to clean.

In this method clothing, eating utensils or other materials are soiled with specific quantities of dirt and bacteria that have been made radioactive. On exposure to X-ray film after washing, any dirt and bacteria remaining are registered on the film. Measurements are reported to be 98% accurate.

Tests with these radioactive materials have been used by the Foundation to measure the effectiveness of home laundry machines and to study the removal of dirt and bacteria from dishes and other eating utensils. [From *Health Officers News Digest,* **17** (4) 18 (1952) April.]

Advertisers' Index

	PAGE
Alrose Chemical Co.	29
American Can Co.	5
American Optical Co.	17
Distillation Products Industries	1
Dodge & Olcott, Inc.	31
Felton Chemical Co., Inc.	15
Firmenich, Inc.	11
Florasynth Laboratories, Inc.	36
Food Development Laboratory	38
Food Machinery & Chemical Corp.	23
Food Research Laboratories, Inc.	38
Fritzsche Bros., Inc.	38
General Foods Corp. (Diamond Crystal-Colonial Salt Div.)	33
Givaudan Flavors, Inc.	27
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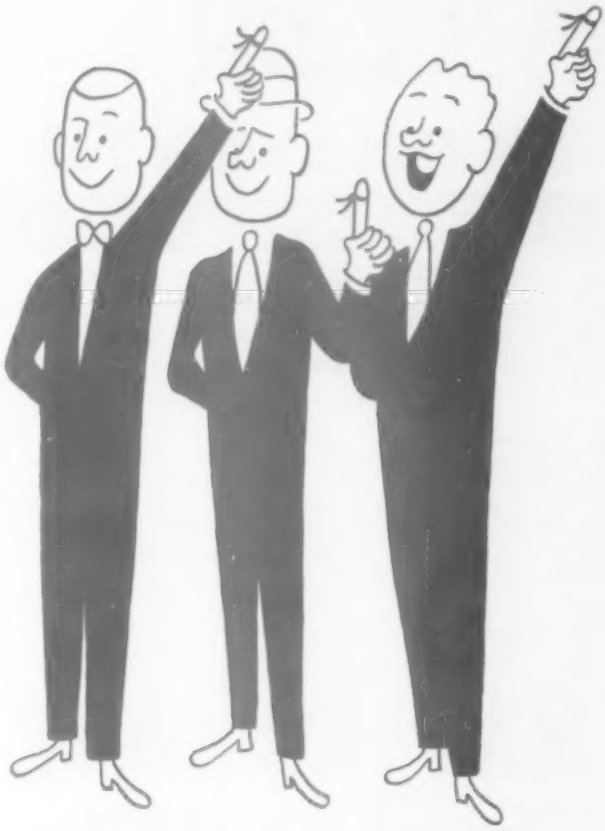

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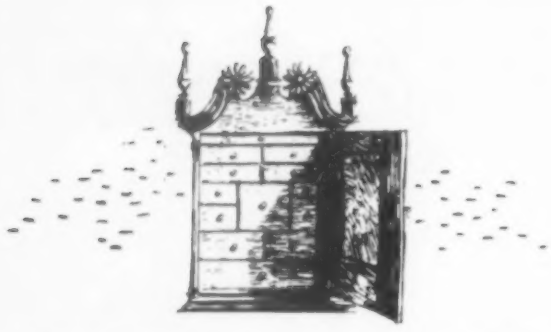

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NATIONAL SCIENCE FOUNDATION ISSUES TENTATIVE GUIDE FOR USE OF PROSPECTIVE GRANTEES IN PREPARING SCIENTIFIC RESEARCH PROPOSALS

The first draft of a guide to assist scientific research investigators in the preparation of proposals for National Science Foundation research grants has been issued by the Foundation. Copies of the guide will be distributed widely to universities and colleges, laboratories, and other organizations in a position to carry on competent scientific research.

The Foundation will support basic research in the mathematical, physical, medical, biological and engineering sciences, by making grants for such research to educational, industrial, governmental or other institutions, or individuals. Ordinarily grants will be awarded to institutions for research by specified individuals.

In reviewing proposals the Foundation will emphasize the scientific merit of the suggested research, including the competence of the scientist under whom the study will be made.

During the current fiscal year the Foundation has earmarked approximately $1,500,000 for support of basic scientific research. A copy of the guide which describes this program in some detail is attached.

FUTURE DATES FOR FOOD TECHNOLOGISTS

Nov. 10-12	National Academy of Sciences, St. Louis, Missouri
Nov. 17-20	Annual Convention of the American Bottlers of Carbonated Beverages, Atlantic City, New Jersey
Nov. 30-Dec. 3	Forty-eighth Annual Meeting of the American Society of Refrigerating Engineers, New York, N. Y.
Dec. 7-10	American Institute of Chemical Engineers, Cleveland, Ohio
Dec. 28-31	One hundred and nineteenth Meeting, American Association for the Advancement of Science, St. Louis, Missouri
1953	
Mar. 15-18	One hundred and twenty-third National Meeting of the American Chemical Society, Los Angeles, California
June 21-25	**Thirteenth Annual Meeting of the Institute of Food Technologists, Boston, Massachusetts**

(Information concerning future dates of national and international meetings, conventions and exhibits of interest to food technologists should be sent to the editorial office.)

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WANTED: Food Technologist for work in production of glaced fruits, pineapple, cherries, orange, lemon and citron rinds, also jellies, jams and preserves. Location near Monterrey, Mexico. Ability to speak Spanish helpful but not necessary. REPLY BOX 218, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

WANTED: Food Technologist for quality control on frosted, canned fruits, juices, purees, etc. Location Lake Erie area. Permanent position. Good opportunities for advancement. REPLY BOX 219, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

AVAILABLE: Food Technologist. Presently employed. 5 years varied experience, research, production, sales, procurement. Well acquainted with major packers throughout U. S. Interested in sales or procurement, canned or frozen foods. Will travel U. S. or foreign. REPLY BOX 217, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

AVAILABLE: Food Technologist, Ph.D., ten years experience in food industries. Presently employed. REPLY BOX 220, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

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IN 1953

Nationally recognized food engineer with extensive industrial experience in production management and research development interested in making a connection with progressive food processing organization in a position justifying $20,000-$25,000 salary. Can offer exceptional references. Inquiries invited. REPLY BOX 216, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

FOOD TECHNOLOGIST: For Container research and development with nationally known paper convertor. Should have minimum of four years experience in food chemistry, bacteriology, food packaging. Submit resumé, salary requirement and references. Superior working conditions including medical and surgical plans, hospitalization plan, annuity plan and life insurance coverage equal to salary. Congenial co-workers. Eastern location available to metropolitan area. REPLY BOX 222, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

WANTED: Dairy chemist, graduate degree, background physical and biological chemistry, for research and development work with expanding milk processor. Must have initiative to assist in planning and organizing his own work. Industrial experience helpful but not required. In reply describe education, experience, state age and salary requirement. REPLY BOX 221, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

AVAILABLE: Chemist with M.S. in foods, experience in fats and oils, carbonated beverages, development of new food products, taste panel work. Desires position in supervisory or liaison capacity in food field. REPLY Box 224, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

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The demand for fish was somewhat exaggerated during the immediate postwar years by the unsatisfactory food situation in France. While the over-all consumption was limited by the supplies available, some species, particularly herring, which are normally considered somewhat inferior, were bought eagerly at high prices. Demand has now returned to a more normal pattern. (Fishery Leaflet 381, U. S. Dept. of the Interior.)

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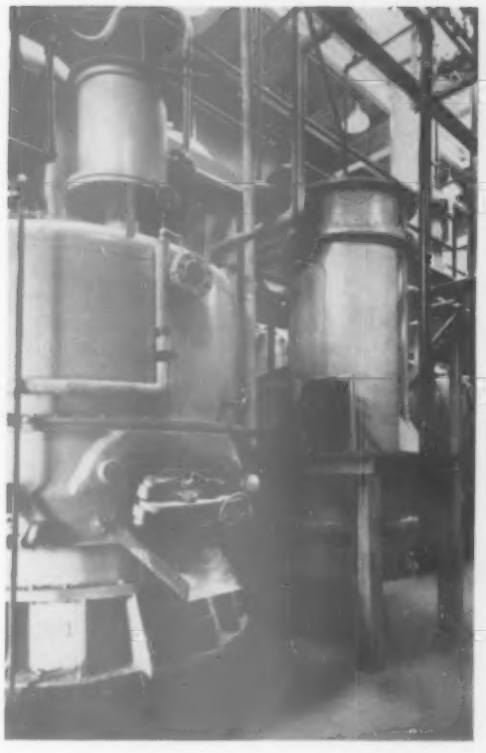

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***See article in November 1952 FOOD TECHNOLOGY Magazine "The Use of Monosodium Glutamate in Frozen Foods" by Carl B. Norton, Donald K. Tressler & Lillian D. Farkas.

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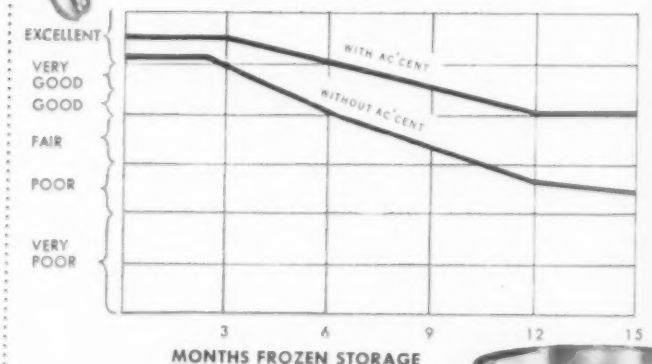

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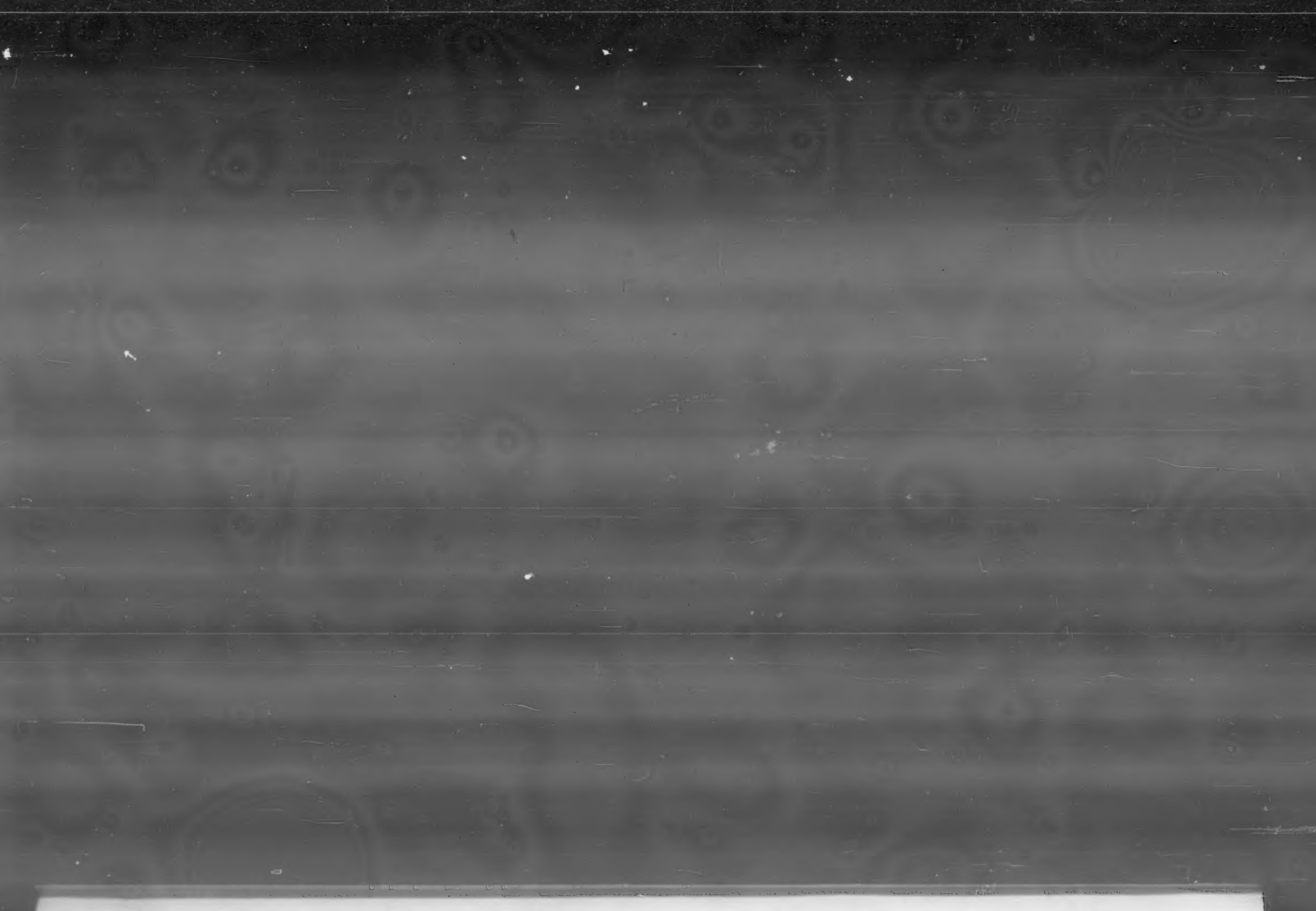

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CONTENTS

INTERIOR QUALITY AND FUNCTIONAL PROPERTIES OF OILED AND THERMOSTABILIZED SHELL EGGS BEFORE AND AFTER COMMERCIAL STORAGE. Agnes Frances Carlin and Janiece Foth 443

YEASTS OCCURRING IN CITRUS PRODUCTS. J. Recca and E. M. Mrak 450

RESEARCH ON FLEXIBLE FILMS FOR FOOD PACKAGING. L. J. Hayhurst 454

THE CONTROL OF THERMOPHILIC BACTERIA. Harry J. Pappas and Lloyd A. Hall 456

COLOR OF CAPSICUM SPICES. I. MEASUREMENT OF EXTRACTABLE COLOR. J. B. Moster and A. N. Prater 459

NUTRITIVE VALUE OF CANNED FOODS. NO. XLIV. ENZYME INACTIVATION AND ASCORBIC ACID RETENTION IN VEGETABLES BLANCHED AND HELD UNDER DIFFERENT CONDITIONS PRIOR TO CANNING. Pauline C. Paul, W. F. Robertson, W. H. Case, R. E. Marshall 464

SUGAR AND ACID TOLERANCE OF SPOILAGE YEASTS FROM SWEET-CUCUMBER PICKLES. Thomas A. Bell and John L. Etchells 468

PRACTICAL APPLICATION OF TIME AND MOTION STUDY TECHNIQUES AS USED IN GENERAL FOODS. R. H. Pratt . . . 472

SOME FACTORS AFFECTING THE PECTIN GRADE OF APPLE POMACE. E. C. Dryden, J. J. Willaman, and Claude H. Hills 474

VOLUME VI, INDEX 479

AFFAIRS OF THE INSTITUTE

NICHOLAS APPERT (1752-1952) *4*

REGIONAL SECTION NEWS *8*

BOOKS *12*

SELECTED ABSTRACTS *20*

Authors of papers intended for publication in FOOD TECHNOLOGY should request from the editorial office a copy of the booklet, entitled "Information and suggestions to authors." Manuscripts submitted for publication in FOOD TECHNOLOGY should follow the style described in this booklet.

The Institute of Food Technologists assumes no responsibility for statements in contributed articles appearing in FOOD TECHNOLOGY. Editorials present only opinions of the writers and do not necessarily reflect policies of the Institute of Food Technologists.

Affairs of the Institute

Nicholas Appert (1752-1952)
A Preface to the Presentation of the Award
News of the Regional Sections
Personnel
Books
Selected Abstracts
Food World News
Future Meetings

NICHOLAS APPERT (1752-1952)

A PREFACE TO THE PRESENTATION OF THE AWARD

It seems somehow inappropriate to permit the year 1952 to end without a brief commemorative statement on Nicholas Appert, an imposing figure in industrial history and one of the world's greatest benefactors. The short presentation speech that follows, made on the occasion of the Appert Award by Mr. Virgil O. Wodicka of the Chicago section, therefore fulfills a dual purpose. It furnishes background material on Appert which is not widely known and pays tribute to the most recent of the distinguished company of Appert Award winners, Edward Mackay Chace.

Two hundred years ago, on the twenty-third of October, 1752, the event of the birth of Nicholas Appert was of purely local interest. He was born in France, a country then basically prosperous, in which the idea was beginning to develop that there could be such a thing as too much government. In his boyhood, Appert's native land became involved in border disputes on the other side of the world and seven years of inconclusive warfare ensued. As he grew into manhood he became identified with the business of feeding people; by the time he had reached maturity he was as well trained in the processing and handling of food as his day and age permitted, and he had risen to a position of responsibility.

To maintain perspective, however, it is necessary to remember that in the world Appert knew, chemistry was just emerging from the shadow of black magic and alchemical chicanery. Bacteriology was several generations in the future. In one sense Appert was fortunate. It was possible then for one man to know what was knowable about a variety of broad fields, each of which is segmented today into a host of complex specialties.

While Appert was developing his knowledge and skill, his country was passing through a time of troubles. The government of his boyhood had been turned out, giving way to a succession of leaders who bent every effort to pleasing the mob. The penalty for failure was a bumpy ride to the guillotine. Lack of confidence in the government brought severe inflation and the government's attempts at price control were largely ineffective. Eventually a popular leader arose on whom the various factions could agree.

Domestic unity, however, was not followed by international amity, and the day of the mass army was at hand—with Napoleon, on horseback, at its head.

Napoleon is known to all for his remark that an army marches on its stomach. The remark, however, was apparently an irritated cry of frustration rather than the enunciation of a principle of war. The Napoleonic armies, in fact, lived largely off the country and were able to manage this practice by not staying long in one place. Napoleon himself was impatient with such trivia as subsistence, and his lack of attention to logistics was an important factor in the disastrous outcome of his invasion of Russia.

At this point in history *laissez faire* economy was only in the discussion stage; managed economy was standard practice. Apparently the ideas of Geopolitics were also stirring, because the managers of the economy were desperately trying to separate the economy of England from that of the Continent and to build up a continental economy in which France would play the dominant role. Every effort was being made to develop the beet sugar industry in France to remove the necessity of importing cane sugar. The problem of preserving a wide variety of food stuffs for military operations and sea voyages was recognized, but received nothing like the emphasis given the sugar problem.

Meanwhile, by application of his large fund of knowledge and by patient and systematic experiment, Nicholas Appert had developed techniques for pasteurizing milk and wine and for canning a variety of meats, vegetables and fruits. Several government agencies had Appert's work under study for 3 or 4 years and finally in 1810 he received an award from the government of 12,000 francs in return for publishing his meticulously detailed instructions for canning together with a long list of recipes both for canning and for using the canned products. The award enabled him to establish the House of Appert as a commercial enterprise and thereby to found the canning industry.

After two centuries have elapsed, it should be interesting to compare Appert's time and ours. We do not today have an active guillotine in the civilized portions of the world, but I am sure that many other elements of the situation in Appert's day must sound at least somewhat familiar. Today as in the day of Appert we have the problem of feeding effectively large armed forces. We do not now, to be sure, try to subsist them from the resources of the region in which they happen to be located; we are, on the contrary, straining the food-growing resources of the entire world, turning food crops into non-perishable form, and transporting the stabilized product of our endeavors to the areas of decision. Again government bodies are investigating every new idea developed anywhere for more effective ways of growing, manufacturing, transporting or storing food.

Today, however, it is completely unlikely that an unknown inventor will suddenly publish, as did Appert, a fully developed and revolutionary procedure for preserving foods and in so doing climax his life's work. Today such a procedure would be the work of many minds and hands. We no longer ask a man to build a whole house with his own hands. We recognize today that if many men together can each build a part, the house will be built better and faster. What is more, through this highly integrated procedure, it will get built with more general pleasure in the building.

We who have dedicated our various skills to the maintenance and extension of that structure we know as Food Technology can never forget Nicholas Appert,

(Continued on page 8)

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Nicholas Appert (1752-1952)

(Continued from page 4)

the architect and master builder whose vision produced the first plan and whose careful placement of stone upon stone laid the secure foundation. Annually, we now take a brief recess from our labors to stand off and admire the achievement of some careful workman of our own day, taking the occasion to draw inspiration from the combined genius of those who have led the way, from Nicholas Appert down to the current medalist. This year, on the auspicious occasion of Appert's two hundredth anniversary, the master craftsman who has been chosen by his fellows for the enduring worth of his building and for his inspiration to the apprentices is Mr. Edward Mackay Chace.

VIRGIL O. WODICKA.

Regional Section News

NEW YORK SECTION

Enzymes Evaluated. Use of enzymes in various phases of food manufacturing and processing presents interesting possibilities and many technical and economic problems. And a number of these were brought out in a talk by Dr. Gerald Reed, Rohm & Haas, at the October meeting of the New York Section of IFT.

Taking lactase, an enzyme which splits milk sugar, as one example, Dr. Reed traced the many steps and problems that would be involved in producing it and in applying it in the manufacture of ice cream to overcome "sandiness." He also discussed the use of enzymes in baking, wine making, desugaring egg whites, milk sterilization, flour bleaching, and chill-proofing of beer.

The 143 technologists attending the meeting were given a most realistic appraisal of the amount of research required to put enzymes to successful practical use in the food field.

CHICAGO SECTION

Members of the Chicago Section experienced an interesting and enjoyable day Saturday, October 11th on the campus of the University of Illinois at Champaign, Illinois. Host was the Department of Food Technology.

The program began with a tour through the food technology buildings. In the past, the many activities of the department were housed in scattered quarters. The main office and some staff offices were located in Mumford Hall. The dairy manufacturing building housed the facilities for chemical and micro biological activities. The new quarters are in the recently constructed animal science building, with 5000 square feet assigned to the division. Processing work will be in the Horticulture Field Laboratory where about 1500 square feet of space is available, including cold storage rooms.

The 115 members and guests attending participated in a most pleasant luncheon which was followed by a short program with Dr. L. B. Howard, Associate Director of the Agriculture Experiment Station acting as host. Dr. R. R. Legault, acting head of the department since Dr. Howard's illness, delivered the welcoming address and introduced the president of the student chapter, Bernard Brockfield, as well as the student and faculty committees. Among those at the speakers' table were Dean R. R. Hudleson and Provost C. R. Griffith. George Brissey, Acting Chairman of the Chicago Section, thanked the hosts for their excellent work in arranging the program. The main speaker was Dr. A. L. Elder, Director of Research of Corn Products Refining Company, Argo, Illinois. Dr. Elder departed from his published subject and reviewed the background of the founding of the University of Illinois Department of Food Technology. In 1943 the President of the University appointed a committee to study the need for such a department. In 1945 an Industry Advisory Committee was appointed. In 1946 a conference was held at the University. As a result of this conference, present curricula of the department was developed.

The program was completed by attending the football game between the University of Washington and the University of Illinois.

We were advised that the Food Technology Division of the University of Illinois aims to train students for positions in dairy and other food processing plants and to conduct research on problems in food technology. Work is offered leading to the degrees of B.S., M.S., and Ph.D. in both food technology and dairy technology. Students receive basic training in chemistry, micro biology, physics, mathematics, engineering and in specialized fields. Research includes work on dairy technology, fats and oils, and pilot scale studies in the field of food processing.

* * *

Don't forget to bring your friends to the most interesting December 8th meeting to hear Mr. P. A. Goeser of Swift and Company speak on "The Art of Carving." He will not only discuss the art of carving, but will demonstrate on several varied types of cooked meats.

On Monday, January 12, 1952, Dr. Nelson Allen of E. I. Dupont de Nemours & Company will speak on "Packaging of Perishable Products." This will be a discussion of some of the various films and materials used as wrappers for perishable products.

WESTERN NEW YORK SECTION

The Section held its Annual Fall Meeting on October 24th at the Hotel Powers, Rochester, N. Y. The afternoon session was addressed by two speakers—William Kazanjan, Iroquois Beverage Co., Buffalo, N. Y., who spoke on "Controlling Quality in the Brewing Industry" and William Miles, Hilton-David Chemical Co., Cincinnati, Ohio, who discussed "The Use of Food Colors in the Food Industry." Following the evening dinner, Dr. Edmund H. Hamann, Fritzche Brothers Inc., New York, N. Y., gave a talk on "The Production of Essential Oils in Various Parts of the World" accompanied by a moving picture on the same subject. At the time of writing this report it was expected that other speakers would be on the same program.

OREGON SECTION

The Section met on October 3rd at the Containers Corporation of America, Portland, Oregon. A business meeting preceded a guided tour of the Corporation's

(Continued on page 10)

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Regional Section News

(Continued from page 8)

plant and its Sefton Can Division. Mr. Jack Burness, Assistant Sales Manager of the Corporation and Mr. Jack Baird, Office Manager of the Sefton Can Division gave informative talks on the process of container manufacturing.

MARYLAND SECTION

The Section opened its current season with a meeting on September 19 at the Plant Industry Station, U. S. Department of Agriculture, Beltsville, Maryland. The program for the evening was presented by the Handling, Transportation, and Storage of Horticultural Crops Division and consisted of an inspection of the facilities and a discussion of various aspects of the work of the Division with the following titles:

Work of the Division—W. T. Pentzer, Head.
Quality evaluation—K. D. Demaree and C. W. Culpepper.
Vitamin laboratory—B. Ezell and Marguerite Wilcox.
Transportation and Storage—W. T. Pentzer and R. C. Wright.
Tomato ripening—M. C. McCulloch.
Packaging—R. E. Hardenburg and M. Lieberman.
Refrigeration in retail stores—William Lewis.

The October meeting was held on the 10th at the Hotel Stafford in Baltimore with Mr. John Bolanowski, Pilot Plant Manager, The Votator Division, The Girdler Corporation, Louisville, Kentucky, as guest speaker. Mr. Bolanowski spoke on "Rapid heat transfer and its utilization in modern food industries."

PHILADELPHIA SECTION

On Thursday, October 16th, the Section held its Monthly Dinner at the Whittier Hotel, Philadelphia. Speaker for the occasion was Mr. C. W. Brabender, Consultant, The Pillsbury Mills, who discussed the topic "Physical Versus Chemical Evaluation Methods in the Milling and Baking Industries."

GREAT LAKES SECTION

The Section held its Fall Meeting on October 10th at the St. Clair Inn, St. Clair, Michigan. In the morning members toured the Chris-Craft Boat Works in Algonac, Michigan. Arrangements were made by Mr. W. J. Mahon of the Diamond Crystal Salt Company, St. Clair, Michigan. In the afternoon Dr. R. R. Baldwin, General Foods Corp., addressed the group on "Radioactive Tracer Techniques in Food Research" and Dr. G. P. Whitlock, Merck & Company, followed with an address on "Vitamins and Food Fortification." In the evening the after dinner speaker was Dr. H. H. Mottern, Laboratory Manager, Kraft Foods Company, Glenville, Illinois, who discussed "Organization and Administration of Industrial Research."

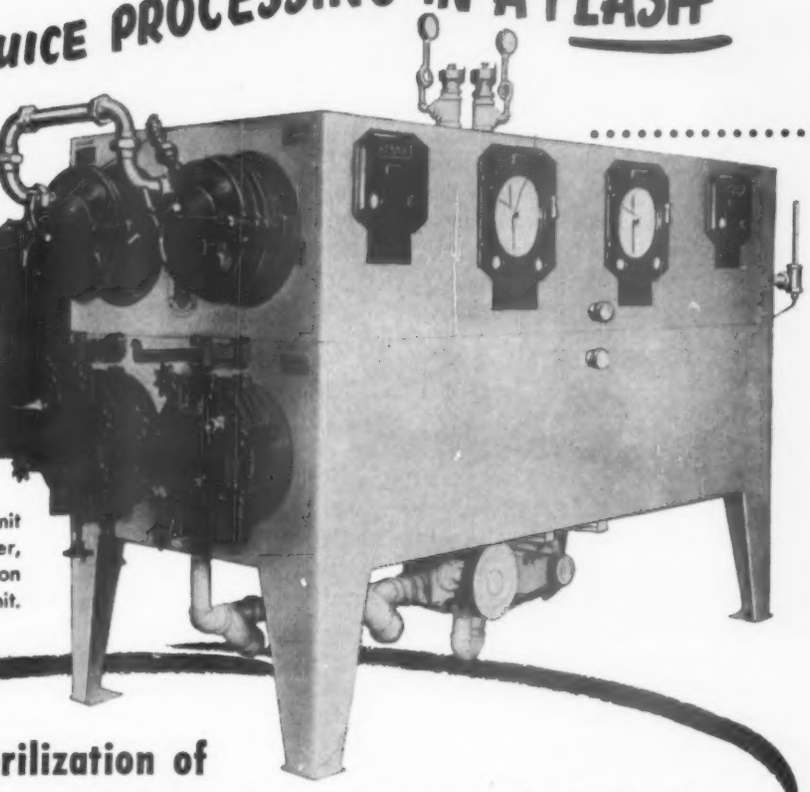
NORTHEAST SECTION

The Section's November 6th meeting, held at the Hotel Brunswick, Boston, Mass., took the form of a "wine tasting (and imbibing) dinner. Here's the way the notice read: "Through the courtesy of Mr. Charles Codman and Mr. Lawrence Miller of the S. S. Pierce

(Continued on page 12)

fmc JUICE PROCESSING IN A FLASH

- continuous operation
- compact, self-contained
- completely automatic

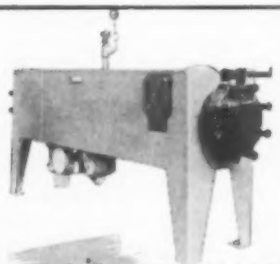


FMC Juice Processor, complete 4-Unit Type, includes Preheater, Pasteurizer, Holding Section and Cooling Section —all in one self-contained unit.

Complete sterilization of fruit and vegetable juices by continuous Flash Heating

FMC 3-Unit Juice Processor is comprised of Pasteurizer, Holding and Cooling Sections.

FMC Double Unit Juice Processor has self-contained Pasteurizer and Cooling Section.



FMC Single Unit Processor, used chiefly for citrus fruit juices, is the Preheater Section only.

Fruit and vegetable juices are completely sterilized in a matter of seconds by the flash processing method employed in the FMC 4-Unit Continuous Juice Processor. All elements of this compact unit are contained in a single sturdy frame, fully insulated for most economical operation. Contact parts are made of stainless steel, and are readily accessible for easy cleaning and maintenance. Operation is continuous and completely automatic, with the temperature of the heating and cooling sections closely controlled by flush mounted instruments which can be adjusted to meet requirements according to the particular product being handled. Flash processing, or pasteurizing, offers the advantages of thorough juice sterilization while making it possible to retain natural color and flavor of the product.

Write for full information, or call your nearest FMC representative

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Canning Machinery Division

General Sales Offices:

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Regional Section News

(Continued from page 10)

Company, we are presenting a dinner at which time the quality of French wines vs. California wines and the judgment thereof will be discussed. Samples will be available for tasting—and also available for imbibing!"

Mr. Codman, a connoisseur and professional wine buyer who has travelled widely in Europe, had many interesting stories to tell. Mr. Miller is in charge of sales for the famous S. S. Pierce Company.

PERSONNEL

F. H. REUTER, Associate Professor of Food Technology, Food Technology Department, School of Chemical Engineering, the New South Wales University of Technology, Sydney, has been awarded a Fulbright-Smith-Munt scholarship and will soon be in residence as a Visiting Fellow at the Massachusetts Institute of Technology, Cambridge. Professor Reuter has the unique distinction of holding the only professorial position in food technology in Australia. Increasing interest in food technology in Australia will doubtless expand educational interest in this comparatively new technical field, however, and along with it the faculty ranks. Professor Reuter is the editor of *Food Technology in Australia*, the journal of the Australian Council of Food Technology Associations.

MR. JOSE J. FRANCO-BETANCOURT, M.S., has published in *Agrotecnia*, official journal of the Colegio Nacional de Ingenieros Agronomos y Azucareros, Cuba, an article on the Institute of Food Technologists. This well-written article is "the first article concerning the background and current interest of U. S. food technologists to appear in Cuba," according to Ing. Manuel Maza, Director.

DR. EDMUND H. HAMANN, Chief Chemist in Charge of Flavor Research of Fritzsche Brothers, Inc., New York, completed in October the 25-year tenure of service that gains him membership in the firm's Quarter of a Century Club. The occasion was fittingly celebrated at a luncheon in which F. H. Leonhardt, company President and oldest active member of the Club, his Secretary, Miss Mary G. Neary, Vice Presidents John H. Montgomery, H. P. Wesemann and Fred Leonhardt, Jr., and Comptroller G. A. Wohlfort participated.

R. ADAMS DUTCHER, Professor Emeritus, Pennsylvania State College, has been appointed Special Lecturer and Consultant in Nutrition at the University of Florida, Gainesville, Florida.

DR. LLOYD A. HALL, Technical Director, The Griffith Laboratories, Inc., was the representative of the A.C.S. at the recent inauguration of Dr. Harold D. West as President of Meharry Medical College, Nashville, Tennessee.

DR. HOWARD D. LIGHTBODY, Director of Food Laboratories, Quartermaster Food and Container Institute for the Armed Forces, Chicago, Illinois, retired from his post with this Department of Defense research and development agency on November 21, 1952. Dr. Lightbody, who holds his degree from the University of Chicago, has spent most of the last twenty-five years in conducting or directing research in the field of food and allied sciences for two U. S. Government departments. Prior to his appointment as head of the food laboratories of the Quartermaster Institute, he was affiliated with the Department of Agriculture—first, in the Department's laboratories in Washington and later, on the establishment of the Western Regional Research Laboratory at Albany, California, as head of Biochemistry Division of that organization, which is one of the laboratories of the Bureau of Agricultural and Industrial Chemistry. Dr. and Mrs. Lightbody are moving to Mina, Arkansas, where they have built a home.

Books

THE FOOD OF THE PEOPLE: THE HISTORY OF INDUSTRIAL FEEDING. By Sir Noel Curtis-Bennet. 320 pages. Faber and Faber Ltd., London. 1950. Price: 16 S. net (about $3.00).

The health, welfare, and spirit of employees is a major factor in industrial production. During the past hundred years industrial feeding attained much importance from both the physiological and the morale standpoints and is generally recognized as an important consideration in plant management.

Although this book deals almost exclusively with industrial feeding in Great Britain, much of the background material as well as the developments which took place during the two World Wars will be of interest to the American reader.

The first five of the ten chapters deal with the development of communal feeding and catering through the Middle Ages, the 16th, 17th and 18th centuries, and during the industrial revolution. A great deal of material has been amassed to indicate the methods of feeding as well as the kind and value of the food served. These discussions make one once again happy that the sordid "good old days" are forever over. Throughout these chapters liberal use is made of the masterly volume by the late Jack Drummond and Anne Wilbraham, *The Englishmen's Food*.

The contributions of Robert Owen (1771-1858), "the father of modern industrial catering," are dealt with in some detail in Chapter VI, after which the author turns to the development of industrial catering as we know it today. The important developments during the great wars of this century, a detailed account of British government regulations, and a brief look into post-war catering and the future complete this interesting and readable volume.

The only criticism this reviewer can offer is on the use of an inadequate and haphazard method of citing literature. The dates and places of publications are missing in almost all cases. This makes the references practically valueless for anybody except those already familiar with the works cited or quoted. Even the brief "Bibliography" gives the dates of publication of only half a dozen books of the some 65 listed.

This volume will be of little aid to those concerned with the technical details of industrial feeding. On the other hand, those interested in the evolution and historical background of industrial catering anywhere or

(Continued on page 14)

Really "sealed-in" flavors that defy time are the result of the remarkable new SEALVA process. Each droplet of flavor oil is completely sealed from the atmosphere with an edible protective film. Yet SEALVA powdered flavors are readily soluble in water.

Until the development of SEALVA, there has never been a wholly successful method of overcoming volatility and oxidation of flavor from powdered foods, tablets, etc.

SEALVA flavors are the answer. They will retain strength, quality and freshness throughout the shelf-life required for packaged products.

SEALVA flavors can be supplied in the following flavors and the list is growing daily: *Strawberry, Raspberry, Cherry, Orange, Lemon, Lime, Peppermint.*

VAN AMERINGEN-HAEBLER, INC.

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Aspics
Beer
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Cake Icings
Canned Fruit
Cheese Spreads
Chocolate Milk
Chocolate Syrups
Confectionery
Dehydrated Soups
Dessert Mixes
Flavoring Emulsions
French Dressing
Frozen Fish
Frozen Fresh Fruit
Frozen Fruit Juices
Fruit Fillings (Pie)
Fruit Juices
Fruit Pie Fillings (canned, ready-to-serve)
Gas Whipped Cream
Ice Cream Stabilizers
Marshmallow Toppings
Meringues
Milk Puddings
Pie Fillings (Dry)
Pumpkin Pie Filling
Ripple Ice Cream Syrup
Sauces (Prepared)
Sherbet Stabilizers
Soups
Syrups
Water Gel Desserts

..AND YOUR IMPROVEMENT PROBLEM HERE?

- ☐ Binding
- ☐ Bodying
- ☐ Emulsifying
- ☐ Gelling
- ☐ Modifying
- ☐ Stabilizing
- ☐ Suspending
- ☐ Thickening
- ☐ Custardizing milk & products containing milk solids
- ☐ Improving mouth-feel and flavor
- ☐ Increasing efficiency of component ingredients
- ☐ Modifying ice crystal growth
- ☐ Physical & anti-oxidant protectior
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THEN YOU'LL FIND YOUR ANSWER HERE!

*SeaKem is the trademark for the standardized, water-soluble, sea plant extractives manufactured by the Seaplant Chemical Corporation. Refined by rigidly controlled processes which insure dependable uniformity and purity, SeaKem "Colloids Out of the Sea" are light amber to colorless, free-flowing flaky powders. Available in a variety of types suitable for use in an unusually wide range of food applications (see lists above), SeaKem Products have won acceptance on the basis of proven advantages with leading manufacturers and processors.

Are your food product and improvement problem listed above? Then follow the lead of top food manufacturers and try SeaKem "Colloids Out of the Sea".* Discover how SeaKem Products can help improve *your* food product . . . make it better . . . easier to sell.

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Books

(Continued from page 12)

in food and feeding in their broader aspects will benefit by reading this work.

The book is well illustrated, attractively printed and bound, and has a ten-page index. Z. I. KERTESZ.

GLYCOLS. Edited by George O. Curme, Jr., and Franklin Johnston. 398 pages. Reinhold Publishing Corporation, New York. January 1952. $12.00.

This is one of the series of chemical monographs sponsored by the American Chemical Society in order that comprehensive surveys of certain selected areas may be available for those working in unrelated branches of physical science. Hence, this review will consider the book from the viewpoint of the food technologist.

The editors, who for many years have been associated with the Carbide and Carbon Chemicals Corporation, have had the collaboration not only of twelve associates whose names appear on the title page as contributing authors, but of "practically the entire laboratory force" of their Company. The review of the published literature and patents is supplemented by unpublished data from many sources including other chemical companies. Thus, while the coverage may not be intensive in any particular respect, it is certainly comprehensive. The literature citations at the end of each chapter are numerous and should serve those desiring more detailed information on the glycols and their many derivatives.

Special attention is accorded ethylene and propylene glycols. These, as well as various derivatives, are considered from the standpoint of their commercial history, methods of production, physical properties, chemical reactions and applications. The concluding chapters deal with the toxicological aspects of these compounds and with their identification and determination.

The large number of tables and charts devoted to data on properties of the compounds furnish the basis for possible uses. Except for propylene glycol which is thoroughly discussed as a solvent, humectant and preservative, the applications in food production are not treated exhaustively. Mention is made of ethylene oxide as a fumigant and propylene oxide as a volatile preservative, but the variety of uses in the food industry of polymeric glycol esters as emulsifiers or dispersing agents receive scant attention. In fact, "the polyethylene glycols" are said to be used as "antistaling agents for bread"; what the authors mean (as thousands of pages of government hearings alas attest) is that polyoxyethylene glycol monostearate is used as a softening agent in bread.

Despite this lack of emphasis on food aspects of the glycols and their derivatives, the technologist will find much of interest in a perusal of the book. For instance, the use of ethylene glycol monomethyl ether as a moisture-proofing agent for cellophane or of propylene glycol alginates as ice cream stabilizers and as foam stabilizers for beer will suggest other fields of usefulness of these and similar compounds. Of interest also is the use of propylene glycol itself to protect food production equipment during periods of idleness.

(Continued on page 17)

FELCAFE, FELTON'S NEW COFFEE IMITATION, ACCLAIMED COAST TO COAST!

Conclusive Tests by Manufacturers of a Wide Variety of Products Prove Its Advantages in Flavor, Aroma and Economy

As a result of several years of research and development, Felton Chemical Company chemists have produced a new coffee flavor that has revolutionized the use of coffee in many products. Candy, ice cream and baked goods manufacturers have long been aware of the handicaps presented by the lack of stability of coffee flavor concentrates, and it was this problem which Felton tackled first. Literally hundreds of new chemicals were isolated in the search for proper ingredients, and at least fourteen new specific aromatics were developed.

Never before has all phases of such important matter are no distortion found in any of the products Study carefully the ingredients were listed as outlined in the Felton contributed to the most important Never before has by doing all phases of such important matter are

75 Times Stronger Than Coffee

Felcafé has been found to be at least 75 times stronger than coffee, and its economy is quickly obvious to any manufacturer. Thousands of batch tests have been made, not only by Felton, but by manufacturers using flavors, and based on the commercial conditions of manufacture in the candy, ice cream, dessert, beverage and extract fields. Felcafé has proven its record-breaking economy.

Will Not Cook or Freeze Out

Felton's unusual flavor is non-volatile, and its stability eliminates any worry about cooking off or freezing out. Neither does it oxidize or become rancid.

Candy Manufacturers Applaud Advantages

Felcafé retains its full-bodied flavor in Hard Candy, Toffee, Caramels, Fudge, Soft Centers, Creams and Fondants, Marshmallows, Gum, Starch Jellies, Chocolate.

Ideal for Foods and Desserts

Popular coffee flavor can now be successfully applied to Ice Cream, Ices and Sherbets, Packaged Ice Cream Mixes, Puddings, Syrups, Beverage Concentrates, Gelatin, Pie Fillihgs, Cake Fillings, Icings, Toppings, Sandwich Fillings, Carbonated Beverages, Extracts.

Versatility of New Flavor for Pharmaceuticals

Coffee as a flavor for pharmaceuticals can be a big factor in the success of all kinds of products such as Pharmaceuticals, Lozenges, Troches, Vitamin Tablets, Cough Syrup, Elixirs.

Write For Samples of This Amazing Coffee Flavor

Tell us about the products in which you would like to use Felcafé. We will be happy to send you directions and liberal samples for testing.

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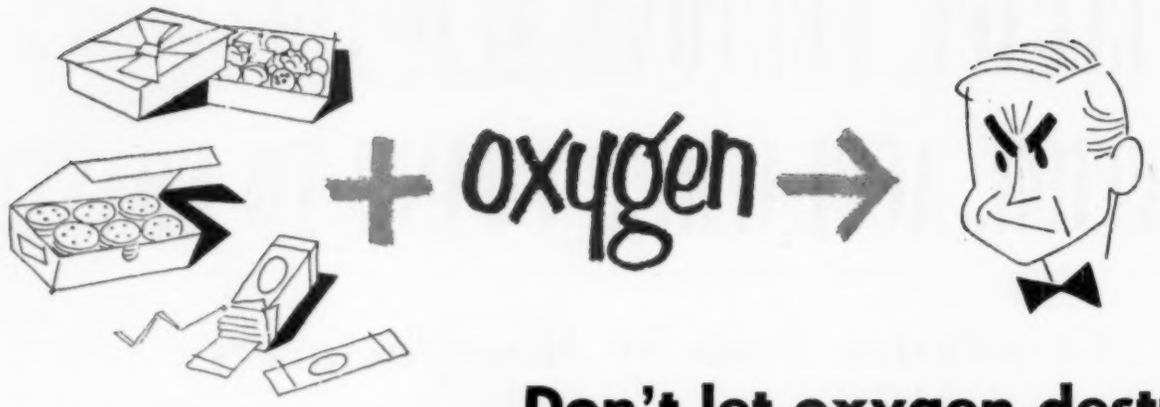

Don't let oxygen destroy your product's reputation

- Baked Foods
- Beef Tallow
- Butter
- Butter Fat Concentrate
- Candy
- Cereals
- Chewing Gum
- Chicken Fat
- Citrus Oils
- Cookies
- Cream
- Dairy Products
- Dog Food
- Essential Oils
- Fish
- Fried Foods
- Lard
- Meat Products
- Monoglycerides
- Nuts
- Oleo Oil
- Packaging Materials
- Pastry
- Premixes
- Spices
- Vitamin A
- Vegetable Oils
- Wax

■ Many food products succumb to oxidative deterioration. Changes in flavor and odor, discoloration, the development of brittleness—these are the damaging results when oxygen goes to work on susceptible or unstable food ingredients.

If you're plagued by the problem of oxidative deterioration, naturally you're concerned about it. Chances are an antioxidant can prolong that period when your product is at its best. That's where TENOX comes in. TENOX is the most successful antioxidant in the food field today. It's helped hundreds of food manufacturers maintain product quality by effectively retarding oxidative deterioration. What's more, it costs only a few cents to protect a hundred pounds of such foods.

For further information about these unique antioxidants, write to Tennessee Eastman Company, Division of Eastman Kodak Company, Kingsport, Tennessee. Our food laboratories will be glad to work with you in solving your food oxidation problems.

Tenox Eastman Food-grade Antioxidants

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Books

(Continued from page 14)

The chemical reactivity of the glycols, manifested throughout the book, indicates wide possibilities for the synthesis of new compounds with properties designed for special uses.

Chemists engaged in food research and development will find this a useful source book and guide to information on a versatile group of compounds.

BERNARD L. OSER.

ADVANCES IN ENZYMOLOGY, Volume 13, Edited by F. F. Nord, 413 pages, Interscience Publishers, Inc., New York, 1952. Price $8.50.

This volume of *Advances in Enzymology* is composed of 9 chapters ably written by international specialists in their fields. Eight of the chapters concern to a marked but not exclusive degree the biology of enzymes, i.e., the part various or specific enzymes play in biological systems. Although much progress has been made in this basic field of study the contributions frequently reveal the controversial position in which we now stand. These chapters contain deductions and comments that will, I feel sure, stimulate the specialist and intrigue the more general reader. The chapters are as follows: Localization of Enzymes in Cytoplasm, by H. Holter, Copenhagen; Some Aspects of the Application of Tracers in Permeability Studies, by Hans H. Ussing, Copenhagen; La Biosynthese Induite des Enzymes (Adaptation Enzymatique), by Jacques Monod and Melvin Cohn, Paris; Genetic Formulation of Gene Structure and Gene Action, by G. Pontecorvo, Glasgow; Adenosine Triphosphate and the Structural Proteins in Relation to Muscle Contraction, by D. M. Needham, Cambridge; Hyaluronidase, by Karl Meyer and Maurice M. Rapport, New York; Certain Aspects of Intermediary Metabolism of Glutamine, Asparagine, and Glutathione, by Heinrich Waelsch, New York; and The Comparative Biochemistry of Nitrogen Fixation, by Perry W. Wilson, Madison. The chapter entitled Stoichiometric Inhibition of Chymotrypsin, by A. K. Balls (Lafayette, Indiana) and Eugene F. Jansen (Albany, California) concerns the nature of this enzyme, for which no active group is known, as indicated by studies with the important nerve poisons, alkyl esters of acylated phosphoric acids.

It is difficult to cite one chapter as being more outstanding than another. Much depends on the interests of the reader. The reviewer was highly impressed with the quality of all the contributions. The chapter on adaptive enzymes, which is in French, contains very interesting and valuable information.

The format, printing, and editing conform to the usual high quality found in previous volumes of this *Advances* series.

HANS LINEWEAVER.

CONTRIBUTIONS OF BROWNING RESEARCH TO RATION ITEM STABILITY. Research and Development Associates, Food and Container Institute, Inc., Chicago, 1952. 56 pages, paperbound. Priced at cost, $1.00.

Presented in this booklet are the papers and essential discussion of a one-day conference held at the Quartermaster Food and Container Institute for the Armed Forces, Chicago, to review the status of research on nonenzymic browning and to appraise the gains made under the Quartermaster Institute's long-range program of browning studies initiated a few years ago by the Committee on Food Research. Emphasis at the conference was on current work devoted to the riddle of degradative changes that occur, or more correctly, are accelerated in heat-processed products (specifically those containing reducing sugars and amino acids) under prolonged, non-refrigerated storage. Contributors to the booklet are Dr. Colin H. Lea, Cambridge University, Dr. Gordon Mackinney, University of California, Dr. Charles D. Hurd, Northwestern University, Drs. Guss and Pyke, Colorado State College, Dr. John C. Speck, Michigan State College, Drs. Wolfrom and Rooney, The Ohio State University, and Dr. Harold S. Olcott, Western Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry, U. S. Department of Agriculture. Experimental approaches, possible course of the reactions, the brown products resulting from the reaction, correlation of model systems with product research, browning research findings and applications to product improvement were among the topics given attention.

By no means a survey of all browning research, the booklet reports in the main the status and some of the tangible profits of the Quartermaster program. Dr. Donald K. Tressler, Dr. Howard D. Lightbody, and Dr. J. H. Mitchell, Jr., arranged the conference, first in a series on military subsistence problems of the Armed Forces that require for their solution the techniques of research.

M. S. P.

A "COURSE" IN CANNING. By John L. Rogers. 187 pages, Food Trade Press, Ltd., London, 1952. Third edition. Price 20/- (by post 20/6).

Newly off the press, the third edition of this excellent little book comes forth from the revision process with no major changes either in text or format. This is as it should be, for the original plan of the book as well as its content is admirably suited to the readers it proposes to instruct.

In the preface the author describes his "course" as one designed for "the Foreman and Charge Hands" engaged in large-scale factory operations. Ex-service men and others returning to the canning trade may, he suggests, find the book a refresher course useful in helping them to advance to work of greater complexity and responsibility. In this reviewer's opinion Mr. Rogers appears to limit his "course" registration rather too rigidly. Since the book furnishes readily understood instruction in the elements of organic chemistry, physics, food processing, and the bacteriological aspects of food, and epitomizes skillfully a number of other phases of food technology—including quality control, time and motion study, and personnel methods—there are many additional groups who might be considered eligible for the course. As an "elective," at least, American students beginning a course of instruction in food technology, members of the sales forces of food com-

(Continued on page 20 following technical papers)

Why these foods have **PLUS VALUE**

With today's big interest in food values, Mrs. Homemaker wants not only good-tasting foods—but foods which she knows are good for her family.

That's why these good foods have been made better, through enrichment. These great grain foods are *dynamic*—because they are rich in energy-producing substances . . . dynamic because of their enormous public acceptance . . . dynamic because they are enriched to overcome the unavoidable loss of important vitamins and minerals which occurs during production.

Please remember this: the quality of the foods you process is vital to your success. In judging the quality of grain foods, it is most important to consider the plus value given to them by enrichment.

Lyons, France

world renowned for its aromatic materials,

the house of

GIVAUDAN

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has developed an outstanding line of flavoring products which offer the delicately balanced quality of the natural aromas plus purity and uniformity obtainable only through rigidly controlled production methods.

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Books

(Continued from page 17-preceding technical papers)

panies, members of the management staff not primarily trained in the food field—all of these and more could spend their time profitably in sessions with this simply presented review of food technology as it pertains to canning.

This is a good book, but it would not be entirely fair to prospective American readers to fail to remind them that British canning technology is not the same at all points as our own. It must also be emphasized that the "course" is not for the specialist; it is written for the reader who would like to have his ducks in a row—that is to say, to have the elementary facts of canning technology organized for him with clarity and dispatch. Since Mr. Rogers achieves this objective, the American reader will doubtless accept with good grace the few paragraphs devoted to preparation or preservation methods no longer widely used in this country.

M. S. P.

Selected Abstracts*

ANALYTICAL METHODS

Determination of glutamine in vegetables.

SORGATO, I., AND SORANZO, B. *Ind. Sacc. ital., 43,* 330-4 (1950); *Brit. Abstracts, C,* 264 (1952).

Detn. of glutamine (e.g. in beet juice) by extn. and crystn. or by pptn. is uncertain, due to losses by hydrolysis to glutamic acid and dehydration of this to pyrrolidinecarboxylic acid. These two reactions can, however, be made quant., and after selective extn. of the last named acid with ethyl acetate, the imino-N can be detd.

A routine method for determination of trichloracetic acid in urine as an evaluation of exposure to trichlorethylene.

WALDMAN, R. K., AND KRAUSE, L. A. *Occupational Health, 12,* 110-11 (1952).

Trichlorethylene has a damaging effect on human organism. Sudden unconsciousness and headache and other symptoms point to acute poisoning. Routine method for evaluating exposure by urine analysis is described.

BIOLOGICAL SCIENCES

BIOCHEMISTRY

The utilization of fructose by human subjects and animals.

WEINSTEIN, J. J., AND ROE, J. H. *J. Lab. Clin. Med., 40,* 39-46 (1952).

Fructose is rapidly removed from the blood. With a continuous intravenous infusion of fructose, the second 25 or 23.5 Gm. are removed from the blood at practically the rate of infusion. Low levels of hyperglycemia and a rapid return to normal blood sugar levels were seen. After the infusion of the first 25 Gm. of fructose, the av. value for reducing substances in the blood was 144.5 mg. %, and at the end of the 50 Gm. infusion, the av. value was 143.9 mg. %. One hour later the circulating blood sugar levels were similar to the preinfusion values. A portion of the injected fructose appears to be converted to glucose, and the latter is detectable in the blood during the period of infusion. Forty-seven % of the maximal rise in the total blood sugar at the end of the infusion apparently is due to the glucose resulting from the rapid metabolic conversion of fructose to glucose. Fructosuria occurred in all cases studied. The av. amt. of reducing substances recovered was 2.3 Gm., or the equiv. of a loss of 4.6% of the fructose infused. The range of urinary mellituria was between 0.96 and 7.4 Gm. Therefore, the tolerance rate (rate of infusion of a sugar without mellituria) for fructose is below 0.76 Gm. per kilogram per hour. The observation of fructosuria assocd. with low levels of fructosemia indicated a low renal threshold for fructose in human subjects.

Some considerations regarding invert sugar and dextrose.

FROST, D. V., MILLER, J. P., AND RICHARD, R. K. *J. Applied Physiol., 4,* 793-6 (1952).

Invert sugar was better tolerated than dextrose with less loss of reducing substances in the urine when the two substances were compared on rapid injection (1.6 gm./kg./hour equal to 100 gm. in 57 minutes to a 70-kg. person) in normal, ambulatory young men. Av. retention was 94.5% for invert sugar and 89.5% for dextrose. This difference probably does not apply at ordinary rates of injection. Further evidence is needed to establish the advantages of invert sugar as a total calories source when given rapidly in large and repeated infusions.

Chromatographic experiments on breakdown of potato starch by malt amylase.

ULMANN, M. *Biochem. Z., 301,* 377-87 (1951); *Brit. Abstracts, A III,* 146 (1952).

To sep. into its constituent substances a mixt. of various breakdown products of starch, the following method was adopted. The mixt. was run on an Al_2O_3 column, part of which has been treated with dil. HCl. The various starch component mols. are selectively adsorbed on such a column. Portions of the column are then treated with the usual iodine-KI mixt. to give colored complexes. In these expts. "maltin," a diastase prepn. was used. As soon as the enzyme begins to act, aggregates of amylose and amylopectin present in the starch soln. are rapidly split. Subsequent amylopectin breakdown leads to the formation of two dextrins, both forming brown-colored complexes with iodine, but distinguishable by their different adsorption properties on Al_2O_3. Subsequent amylose breakdown does not give rise to any substances that will form brown-colored complexes with iodine.

Mechanism of amylopectin formation by the action of Q enzyme.

NUSSENBAUM, S., AND HASSID, W. Z. *J. Biol. Chem., 196,* 785-92 (1952).

Linear dextrins of av. chain length up to about 42 glucose units are not utilized by the Q enzyme of potato for the synthesis of branched amylopectin; 116 units are utilized. It appears dextrin chain lengths between these two values must be available for polysaccharide formation with Q enzyme. Periodic incubation of Q enzyme and amylose resulted in a random conversion of the amylose to a synthetic polysaccharide structure intermediate between amylose and amylopectin. As the reaction progressed, the mol. wt. of the synthetic polysaccharide decreased because of an alpha-amylase impurity.

Structure of proteins.

EDSALL, J. T. *Nature, 170,* 53-5 (1952).

A summary of the several papers on the structure of proteins read before the Royal Society. L. Pauling and R. B. Corey advanced some hypotheses concerning the structure of fibrous proteins.

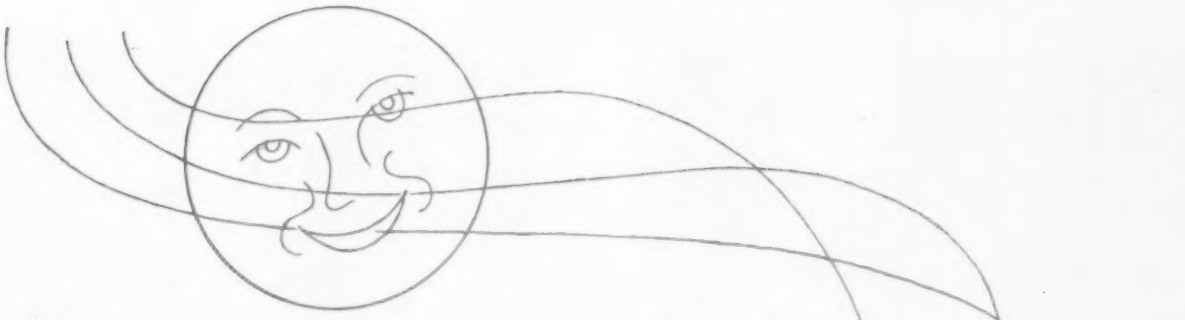
Effect of ionizing radiation on protein denaturation.

FRICKE, H. *Nature, 169,* 965-6 (1952).

At pH 4.85 egg albumen and hemoglobin contained, after irradiation with x-rays, large quantities of species of decreased thermal stability. Large changes in the Arrhenius frequency factor and the energy of inactivation calcd. from the first order denaturation velocity, consts. indicated serious structural injuries due to irradiation.

(Continued on page 24)

* These Selected Abstracts are made available to FOOD TECHNOLOGY through the cooperation of Associate Editor H. A. Campbell and the General Foods Corporation of New York, N. Y. The abbreviations found in these abstracts are similar to those used by Chemical Abstracts.



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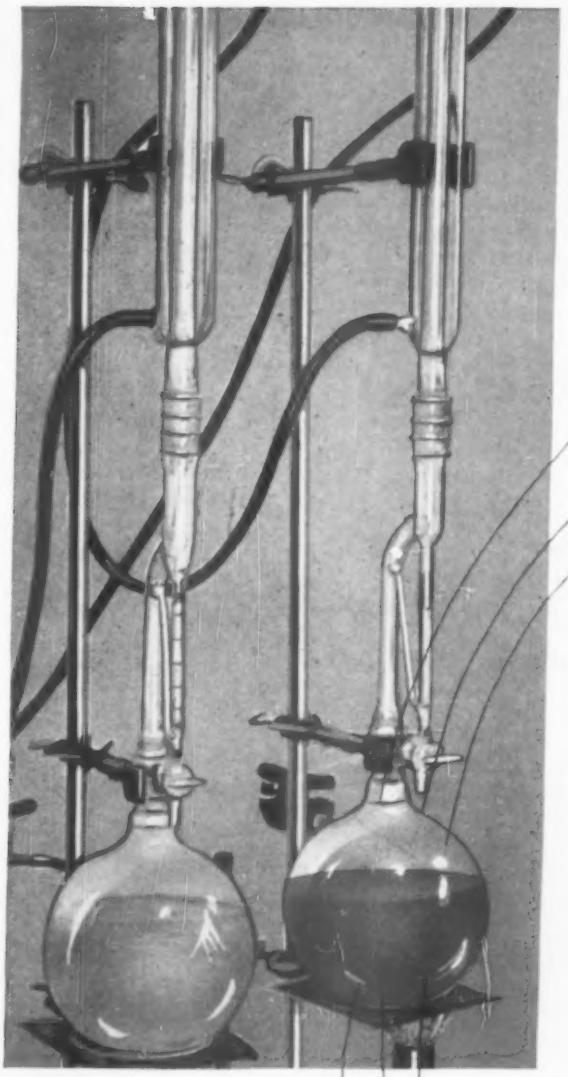

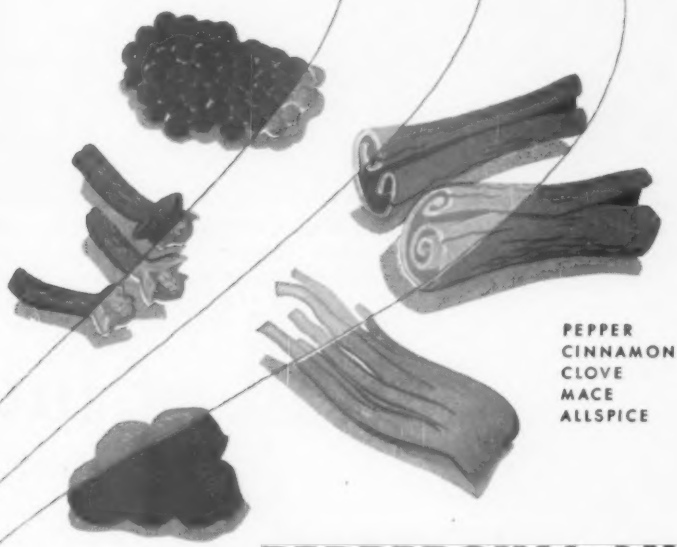

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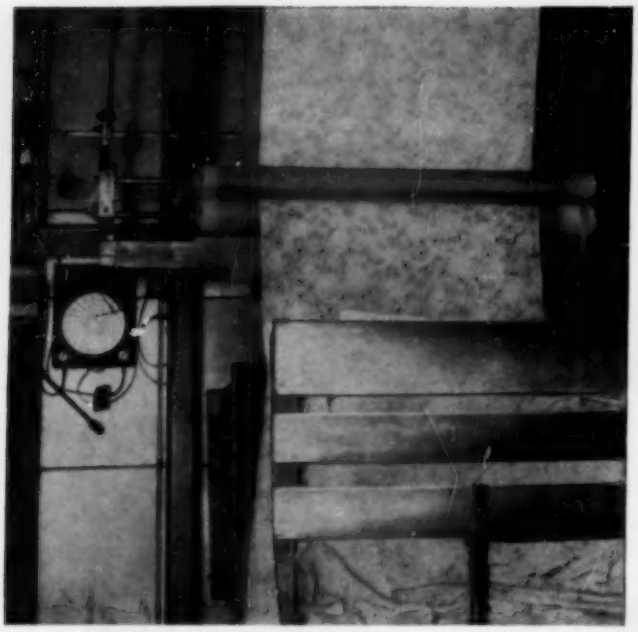
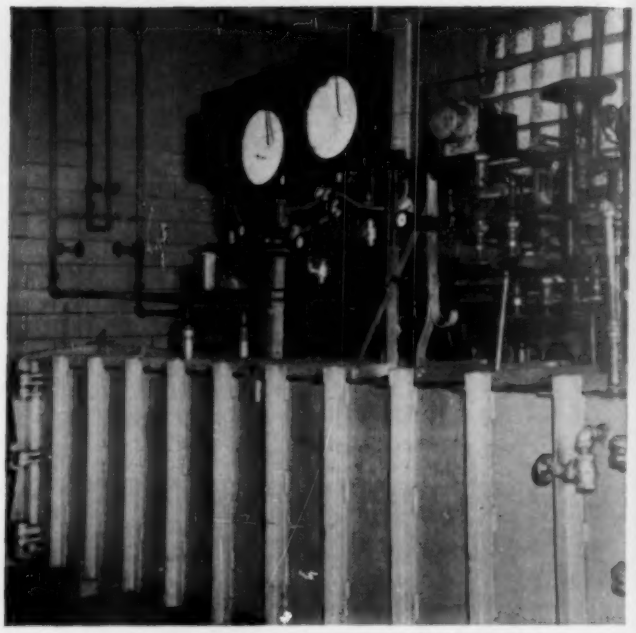
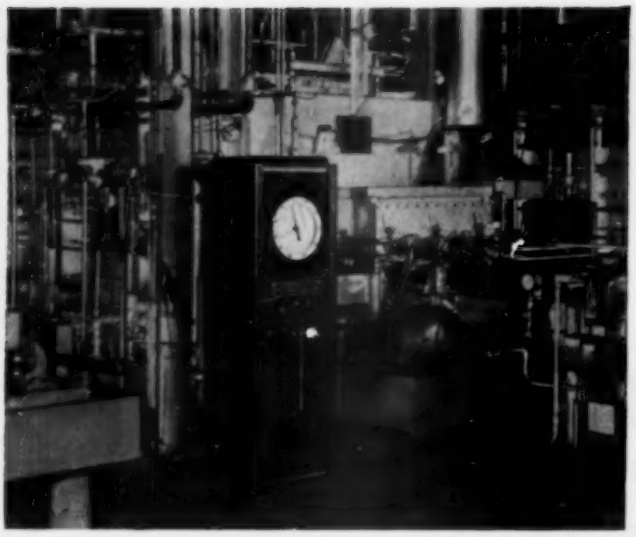


$30,000 SAVING IN ONE YEAR *was effected in this textile finishing mill . . . with the help of the Brown thermometer controlling the temperature of the print dryer. Controlled condition drying eliminated jagged fabric rips which had resulted in absolute waste.*

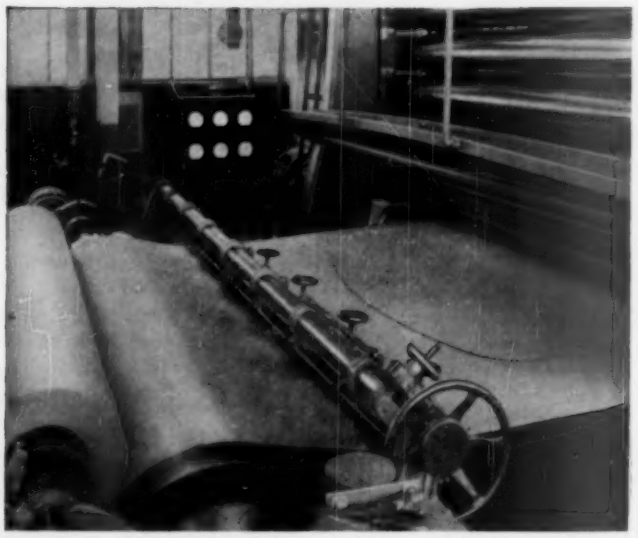


DUAL USE OF RETORT, *thanks to custom-built control system, permits using same equipment for boiling meats that is used for pressure-cooking glass-packed products. Cook time has been cut; glass breakage eliminated; labor saved; and production increased for both jobs.*

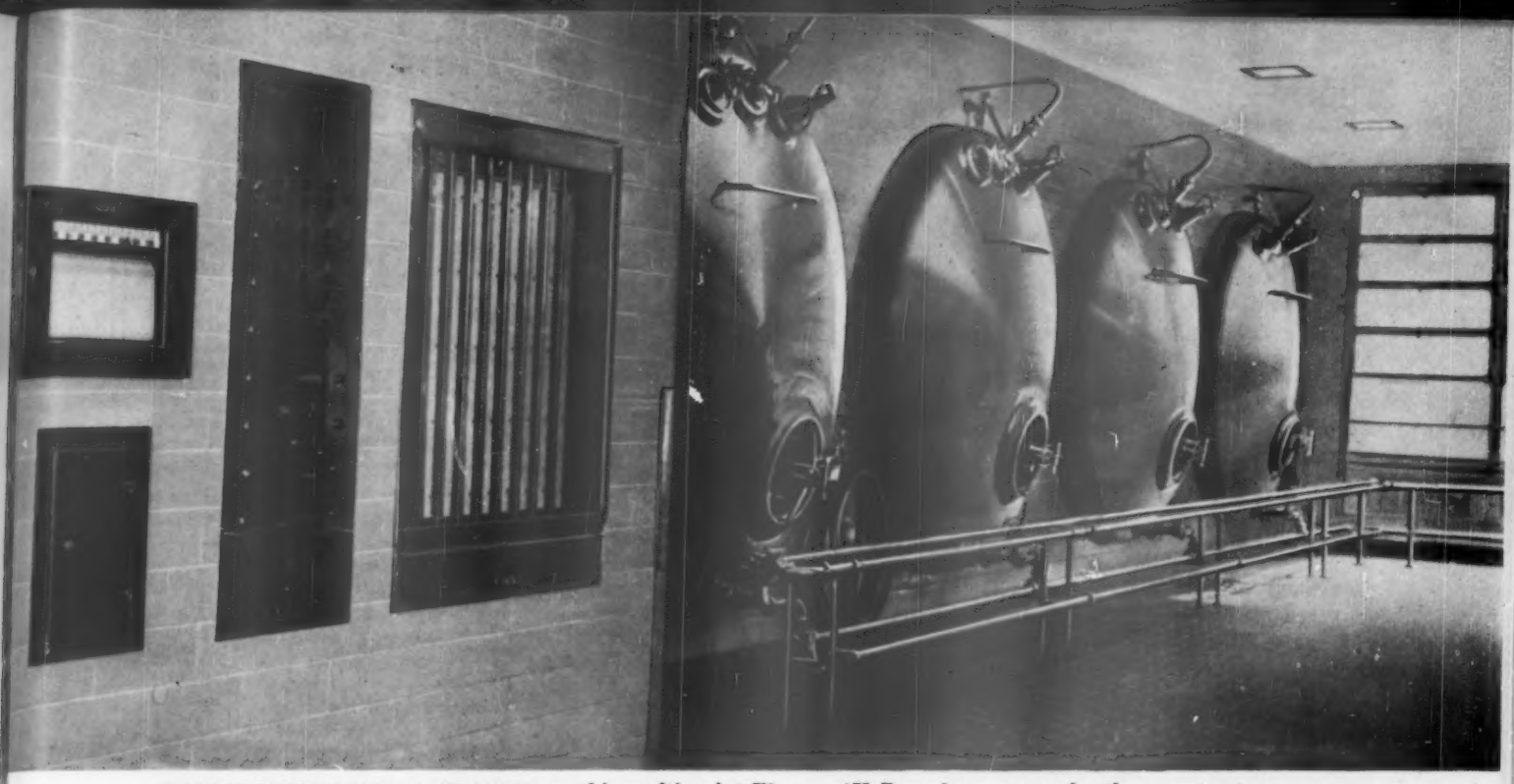
For all of industry... *especially* *Instruments*



PREVENTING COSTLY ERRORS *in heat treatment is the job of this Surface Combustion dew point recorder which utilizes an ElectroniK instrument. Carburizing, nitriding, dry cyaniding, and carbon restoration are affected by the dew point of gases employed, and have a profound effect upon metallurgical results.*



ALL BTU'S ACCOUNTED FOR . . . *in this machine room. Brown integrating flow recorders keep close track of every pound of steam . . . give speedy indication of excessive steam consumption. A variety of instruments hold operating costs at a minimum throughout pulp and paper mills.*



STORAGE TEMPERATURES CENTRALIZED *on this multi-point ElectroniK Recorder are easy for the operator to check at any time in a big eastern dairy's milk storage room. Use of modern thermocouple instruments has brought a large saving in milk tank clean-up time—and has reduced maintenance and repair bills.*

for the food industry

reduce costs

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- *Reduction of product loss*
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Abstracts

(Continued from page 20)

Skeletal units in protein crystals.

WRINCH, D. *Science, 115,* 356-7 (1952).

Recent estimates of the numbers of amino acid residues in various protein structures are of interest in relation to the idea that the manner in which the amino acid backbones polymerize to form the skeletons of native protein mol. may be characteristic for proteins as such (differentiating proteins from amino acid polycondensations which are not proteins). There may be a single skeletal type in all the individual chem. entities of proteins or a homologous series of types embodying some common constructional principle.

Possible biological significance of the action of ionizing radiations on nucleic acids.

WEISS, J. *Nature, 169,* 460-1 (1952).

It is suggested that in the biol. action of ionizing radiations a relatively small primary attack on, for example, a nucleic acid mol., possibly followed by processes of hydrolysis, may be already sufficient to make it biologically inactive, at least for its original functions in the living system.

Cation exchange properties of alginic acid.

LUDWIG, B. J., HOLFELD, W. T., AND BERGER, F. M. *Proc. Soc. Exptl. Biol. Med., 79,* 176-9 (1952).

Alginic acid possesses sodium and potassium ion exchange properties which compare favorably with those of a carboxylic type cationic exchange resin. Under *in vitro* conditions alginic acid at pH 7.6 adsorbs 4.2 meq Na^+ per g. The total cation adsorption from solns. contg. K^+ and Na^+ is also 4.2 meq./g. and the ratio of Na:K combined approximates that present in soln. The adsorption of Ca^{++} by alginic acid is irreversible and independent of pH. The hydrophilic character of the sodium and potassium alginates may contribute to the elimination of fluid and cause laxation.

A spectrophotometric method for measuring the breakdown of hydrogen peroxide by catalase.

BEERS, R. F., AND SIZER, I. W. *J. Biol. Chem., 19,* 133-40 (1952).

A simple, rapid, quant. spectrophotometric method for following the action of catalase on hydrogen peroxide, based upon the measurement of the ultraviolet absorption of peroxide, is suited to studies of catalase kinetics. By this method the breakdown of hydrogen peroxide was found to follow first order kinetics under a variety of conditions and to increase linearly with catalase concn.

In vivo synthesis of methyl groups.

Nutrition Revs., 10, 27-8 (1952).

Methyl alc. sodium formate and formaldehyde were utilized in the synthesis of labile methyl groups in germ-free rats. Radioactive studies demonstrated that the methyl group of methyl alc. was not utilized intact, but acted as a precursor of the biol. labile methyl group. The labeled carbon of C^{14} formyl-L-phenylalanine was found in the methyl groups of rat tissue choline, indicating that this one carbon grouping may be of endogenous origin.

The physical toxicity of chemicals. II. Factors affecting physical toxicity in aqueous solutions.

MCGOWAN, J. C. *J. Applied Chem., 2,* 323-8 (1952).

Evidence indicates that a large no. of simple org. compounds produce toxic symptoms in living organisms when they reach a definite concn. in some biophase. If this is so, for non-assocd. compds. which do not participate in hydrogen-bonding the equation $-\log Ct = -\log C' + k(P)$ is suggested by considerations of soly. Here, Ct and C' are the toxic concns. in water and in the biophase resp. (g. mol./l); (P) is the parachor (c. c.) and k is a const. This equation was found to hold and examples are given. The const. k has been found to have the value 0.012 and C' is const. for any one manifestation of toxicity. Corrections can be applied for the presence in the mol. of the toxic compds. of groupings giving rise to assocn. and hydrogen bonding. The equation is useful for the prediction of toxicities of compds. which would be expected to be physically toxic and for the classification of data on toxicities of aq. solns.

Antibiotics up to date.

KEEFER, C. S. *Merck Rept., 61,* 3-8, April, 1952.

The five most important antibiotics are (1) penicillin for gram-positive infections; (2) streptomycin and dihydrostreptomycin for tuberculosis and gram-negative infections; (3) aureomycin, (4) chloraphenicol, and (5) terramycin for gram-positive and gram-negative organisms resistant to penicillin and streptomycin. Other antibiotics have limited uses, although they are important in special instances. A few combinations of antibiotics have been studied and found more effective in the treatment of certain diseases than when used alone. Contrariwise, some antibiotics exhibit antagonism toward each other. Following the use of antibiotics, a profound alternation in bacterial flora may occur. In most instances, the changes are unimportant but a new secondary infection or superinfection sometimes results. Some strains of micro-organisms are naturally resistant to an antibiotic. Resistance can be acquired against all of the antibiotics by continued use over long periods. Prophylactic use of antibiotics is valuable in preventing secondary infections in patients with acute upper respiratory tract infections; in preventing gonorrhea, streptococcic infections, rheumatic fever recurrences; in reducing incidence of bacteremia following tooth extn. or labor; and in certain surgical procedures.

NUTRITION

The effect of a lactose-free diet on problem solving behavior in rats.

MAIER, N. R. F., AND LONGHURST, J. U. *Jour. Comp. Physiol. Psychol., 43,* 375 (1950); *Biol. Abstracts, 26,* 1566, No. 17204 (1952).

Rats fed on lactose-deficient diets showed retardation in problem solving as compared with rats fed on a lactose-contg. diet. This was particularly true in the female.

Fat but little sweets in anti-arthritis diet.

Science News Letter, 61, 373 (1952).

Patients suffering from rheumatoid arthritis on low carbohydrate and high fat diets showed significant improvement in their rheumatic symptoms. Increasing the starch and sugar content of the diet brought a return of the pain and other symptoms. ACTH and cortisone were also more effective when given with the high fat, low carbohydrate diet.

Study on orange juice, orange juice concentrate, and orange peel oil in infants and children, with special reference to incidence of dermatologic and gastrointestinal disturbances.

JOSLIN, C. L., AND BRADLEY, J. E. *J. Pediat., 39,* 325-9 (1951); *Nutrition Abstracts Revs., 21,* 952 (1952).

A total of 406 children aged between 2 weeks and 6 yrs., 338 of whom were under 3 yrs. of age, were studied for from 2 to 12 months. The youngest infants were given ¼ oz. orange juice daily, and this amt. was gradually increased until at 12 months each child was receiving 4 oz. and the older children 8 oz. per day. Disturbances which might be due to the orange juice were noted, the pH of the different types of orange juice was estd. and patch skin tests were made on 167 normal children and 14 with eczema to est. their sensitivity to orange juice and orange peel oil. Results indicated that the orange juice had no effect on bowel function, and was only occasionally responsible for regurgitation or skin rashes. Only 1.8% of the normal children skin-tested gave positive reactions to orange juice, and 5.3% to orange peel oil. The pH range was from 3.76 for orange juice concentrate to 5.65 for orange peel oil. From the observations made it was concluded that the form of orange juice most readily tolerated by the children was that contg. the min. amt. of orange peel oil.

(Continued on page 26)

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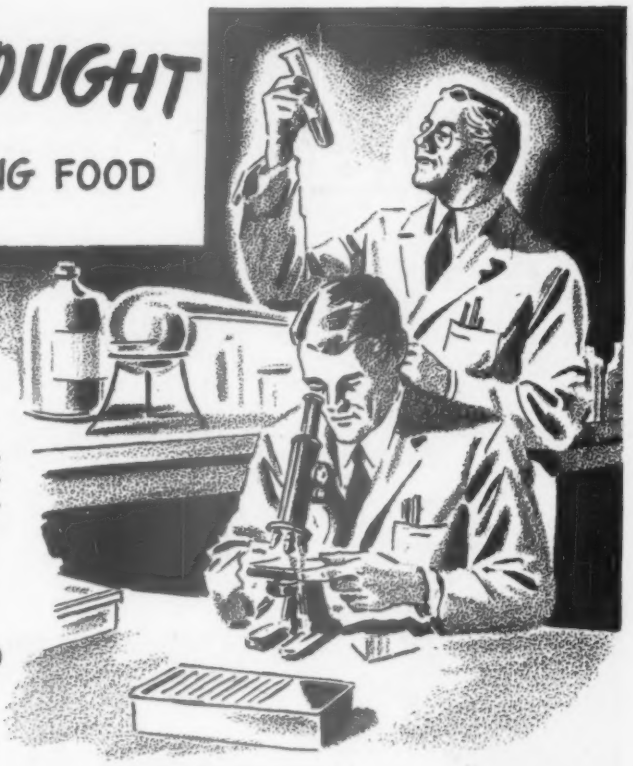

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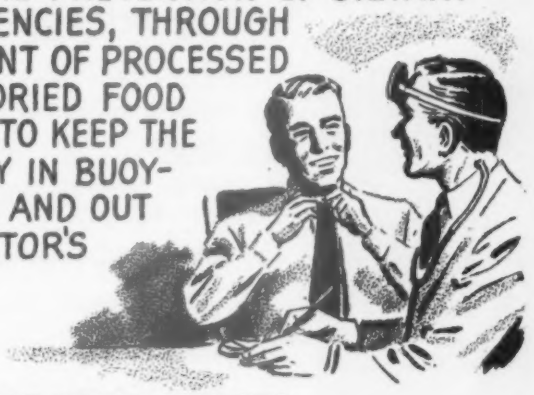

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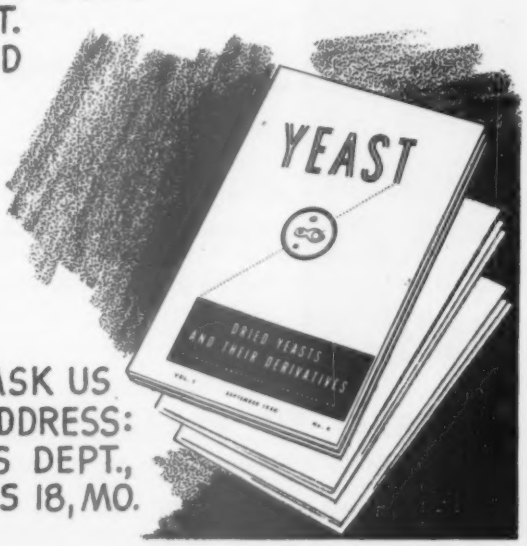

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Abstracts

(Continued from page 24)

A new and biologically different form of vitamin B_{12}.

LEWIS, U. J., TAPPAN, D. V., AND ELVEHJEM, C. A. *J. Biol. Chem., 194,* 539-48 (1952).

A new vitamin B_{12} active material present in the fecal matter of rats has been isolated. The compd. has growth promoting properties for *L. leichmannii* but is inactive in this respect for the rat. The growth response of the chick to the material is comparable to that of cryst. vitamin B_{12}. The new vitamin B_{12} active form moves differently from vitamin B_{12} on paper chromatography and has a different absorption spectrum.

ENGINEERING AND PLANT EQUIPMENT

Control of small liquid flows using glass valves.

GEANKOPLIS, C. J., AND HIXSON, A. N. *Ind. Eng. Chem., 44,* 589-90 (1952).

A glass valve is described which embodies the major design features of ordinary metal needle valves which have satisfactory characteristics for controlling small rates of flow of fluids. This type of valve can be used where reproducible and steady flows are required in the lab. where extreme resistance to corrosion is necessary.

Special heat transfer problems of the food industry.

BOLANOWSKI, J. P., AND LINEBERRY, D. D. *Ind. Eng. Chem., 44,* 657-60 (1952).

A heat transfer app. of special design makes possible the continuous heating and/or cooling of many food products under rigidly controlled conditions of temp. and pressure. The application of the app. in the chilling and plasticizing of lard, shortening, and margarine is discussed. Claims are made that the exchanger is ideally suited for applications where the material is heat-sensitive and very viscous and undergoes a change of state during and/or cooling; such as that found in starch cooking and cooling, gelatin cooling, freezing of concentrates, and chilling and plasticizing of fats and oils.

Anti-bacterial cement gives longer lasting floors.

LEVOWITZ, D. *Food Eng., 24,* 57-60, June, 1952.

Active germicide, incorporated in cement, permanently checks bacteria that break down masonry, thus reducing costly maintenance. When used on walls and ceilings, it inhibits molds and fungi and effectively controls odors.

FOOD AND FOOD TECHNOLOGY

Measuring the physical characteristics of flour: A method of using the Chopin Alveograph to detect the effect of flour improvers.

BENNETT, R., AND COPPOCK, J. B. M. *J. Sci. Food Agric., 3,* 297-307 (1952).

A new technic is described by which it becomes possible to use the Chopin Alveograph for detecting the effect of improvers in flour. In the standard technic, dough pieces for test are shaped by extrusion and flattening by rolling and are tested 20 minutes after mixing. The modified technic involves keeping the dough in bulk for three hours at const. temp., after which test pieces are then weighed off, moulded and again tested. It has been found that the change so recorded satisfactorily reveals the effect of flour treatment; a resting time in the dough and moulding of the dough are required to accomplish this adequately. Examples are given of the use of the method on flours treated resp. with potassium bromate, nitrogen trichloride, chlorine dioxide and ascorbic acid.

Synthetic oils and fats.

SEAMAN, J. *Food, 21,* 164-7 (1952).

It is suggested that substantial quantities of natural oils used in the manuf. of soaps and paints could be up-graded for use in foodstuffs. Synthetic oils and fats could be made from petroleum products to replace them, and ultimately to be used also in food.

(Continued on page 31)

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Lights from windows on white snow, tracked by friendly, crunching footsteps...

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Write to nearest regional secretary, if within an area covered by a regional section, or to the Executive Secretary of the Institute, for an application form and information regarding qualifications and classifications.

Abstracts

(Continued from page 26)

Relation of chlorogenic acid to scab resistance in potatoes.

JOHNSON, G., AND SCHAAL, L. A. *Science, 115,* 627-9 (1952).

The presence of chlorogenic acid in potato tubers was first demonstrated by the use of $FeCl_3$. All varieties highly resistant to scab showed a strong color reaction when treated with $FeCl_3$. The intensity of the green color varied with the degree of scab resistance. The exact nature of this protection has not been detd. but indications are that one or more mechanisms are involved. Since tyrosinase is also concd. in the same area as chlorogenic acid, it may be that both are involved in a general protective mechanism.

A comparative study of tablet disintegrating agents.

GROSS, H. M., AND BECKER, C. H. *J. Am. Pharm. Assoc., 4,* 157-61 (1952).

A comparative study has been made of disintegrating agents commonly used in tablet manufacture. In addn. to the accepted agents used by the pharmaceutical industries, some new agents were studied. The results indicate that two new agents, sponge and citrus pulp, compare favorably with those agents commonly used in the tablet mfg. industry.

Limitations on radiation for sterilization.

Atomic Energy N. L., 7, 2, July 1st, 1952.

A warning that foods rich in fatty acids, such as salad oils, butter, milk, fatty meats, certain grains and seeds should not be sterilized with gamma radiation, has been made by Dr. James F. Mead, of the biochemistry division, of the atomic energy project of the University of California at Los Angeles. While recent work has been directed to the use of gamma radiation (from nuclear waste products) for food sterilization, Dr. Mead explained that if foods with a high concn. of fatty acids are subjected to gamma radiation, these acids and vitamins in the foods will be destroyed. He stated that irradiation releases a chain of free radicals in the food, that these free radicals act on other substances present to produce poisonous peroxides. The peroxides released, Dr. Mead said, are injurious to vitamins and essential fatty acids already in the body.

INDUSTRIAL CHEMISTRY

Why write a description of your position.

SMIDDY, H. F., AND CASE, B. A. *General Elec. Rev., 55,* 46-9, July, 1952.

Ten significant ways in which good position descriptions can be used to help both managers and individuals.

PATENTS (U. S. A.)

Crystal manufacture.

SIMMS, R. K. Assignor to Phillips Petroleum Co. 2,606,023, July 1, 1952.

In a process for the production of cryst. material by supersatg. a soln. thereof and contacting supersatd. soln. with already formed crystals thereby causing them to grow, the improvement which comprises removing the largest crystals produced from the bottom of the crystn. zone through a plurality of outlets symmetrically positioned in bottom more than half the radius of crystn. zone from the center axis thereof, passing thus removed crystals in the form of a magma in a composite stream to a sepn. zone and recovering crystals from sepn. zone as products of the process.

Process for the manufacture of sodium gluconate.

CROCKER, C. K., MOYER, A. J., AND PFEIFER, V. F. Assignors to the United States of America as represented by the Secretary of Agriculture. 2,602,768, July 8, 1952.

Method for the production of sodium gluconate by the direct fermentation of a nutrient medium comprising glucose and a source of organic nitrogen, which comprises cultivating in the medium a gluconic acid-producing organism in the presence of sufficient sodium base to maintain the pH of the medium within

(Continued on page 32)

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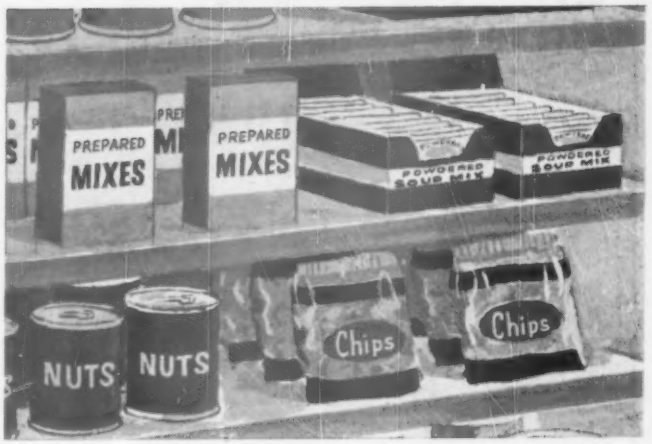

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Abstracts

(Continued from page 31)

the range of 5.0 to 7.5, the pH being maintained by the addn. of supplementary sodium base at a rate substantially equivalent to the rate of production of gluconic acid by the organisms, and recovering sodium gluconate from the fermentation liquor.

Method of accelerating the growth of chicks.

ELY, C. M. Assignor to National Distillers Products Corp. 2,604,402, July 22. 1952.

Method of accelerating the growth of chicks which comprises introducing from 15-200 thousandths of 1% based on the amt. of solid foods, air dry basis, supplied of a fatty acid ester of polyethylene glycol selected from the esters in which the fatty acids carry from 8-18 carbon atoms and in which the polyethylene glycol is formed by condensing from 6-12 mols. of ethylene glycol.

Method of preserving popcorn in solid fat.

MARTIN, G. Assignor to Popcorn Products Corp. 2,604,407, July 22, 1952.

The method of preserving raw popcorn which comprises, placing the raw popcorn in a mold and pouring in sufficient liquefied normally solid vegetable cooking fat to fill the interstices.

FUTURE DATES FOR FOOD TECHNOLOGISTS

Dec. 7-10	American Institute of Chemical Engineers, Cleveland, Ohio
Dec. 28-31	One hundred and nineteenth Meeting, American Association for the Advancement of Science, St. Louis, Missouri
1953	
Feb. 19-20	Winter Meeting of the National Pickle Packers Association, Chicago, Illinois
Feb. 21-25	National Canners Convention and Canning Machinery and Supplies Association Show, Chicago, Illinois
Mar. 1-4	National Frozen Food Convention, Chicago, Illinois
Mar. 15-18	One hundred and twenty-third National Meeting of the American Chemical Society, Los Angeles, California
April 20-22	National Frozen Food Industries Exposition, New York, N. Y.
June 21-25	**Thirteenth Annual Meeting of the Institute of Food Technologists, Boston, Massachusetts**

(Information concerning future dates of national and international meetings, conventions and exhibits of interest to food technologists should be sent to the editorial office.)

SHRIMP FISHERY TO BE DEVELOPED IN ECUADOR

In order to engage in shrimp fishing near the mouth of the Guayas River, an Ecuadoran company has been formed with private capital from the United States. A contract-concession was signed between the Ecuadoran Government and this firm on February 8, 1952.

The firm plans to supply the local demand for shrimp and to reduce the price of this item for the consumer, and will then freeze any excess supply for shipment to the United States. The firm has calculated that the minimum investment required will be approximately U. S. $5,000,000. [*Commercial Fisheries Review* **14** (5) 35 (1952) May.]

$13 BILLION BUSINESS

Pubic feeding is now the fourth largest retail industry in the United States. Its annual volume exceeds $13 billion of sales. [*Health Officers News Digest* **17**, (6) 8, 1952.]

Advertisers' Index

	PAGE
Anheuser-Busch, Inc.	25
Aseptic-Thermo Indicator Co.	35
Continental Can Co.	6-7
Distillation Products Industries	1
Dodge & Olcott, Inc.	10
Felton Chemical Co.	15
Florasynth Laboratories, Inc.	33
Food Development Laboratory	36
Food Machinery & Chemical Corp.	11
Food Research Laboratories, Inc.	36
Fritzsche Bros., Inc.	36
The Garrard Press (IFT)	32
General Foods Corp. (Diamond Crystal-Colonial Salt Div.)	31
Givaudan Flavors, Inc.	19
The Griffith Laboratories, Inc.	21
Hoffman-LaRoche, Inc.	18
International Minerals & Chemical Corp.	34
Johns-Manville	29
LaWall & Harrisson	33
Magnus, Mabee & Reynard, Inc.	2
Minneapolis-Honeywell Regulator Co.	22-23
Norda Essential Oil & Chemical Co.	28
The Pfaudler Co.	2nd Cover
Chas. Pfizer & Co., Inc.	5
Rohm & Haas Co.	4th Cover
Seaplant Chemical Corp.	14
Foster D. Snell, Inc.	36
A. E. Staley Mfg. Co.	27
Sterwin Chemicals, Inc.	9
Tennessee Eastman Corp.	16
Universal Oil Products Co.	26
U. S. Stoneware Co.	3rd Cover
van Ameringen-Haebler, Inc.	13
Vegetable Juices, Inc.	34
Wallace & Tiernan Co., Inc.	34

THE SANITARIANS AWARD

The 1952 Sanitarians Award, the citation presented annually in recognition of professional achievement as a Sanitarian by the International Association of Milk and Food Sanitarians, was presented to Paul Corash, Chief of the Milk Division, Bureau of Food and Drugs, New York City Department of Health, at its meeting held early in the fall, at Minneapolis, Minnesota. The Award, consisting of a Certificate of Citation and $1000,

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was presented on behalf of the Association by Dr. K. G. Weckel, Chairman of the Association's Committee on Recognition and Awards.

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Among the leading contributions of Mr. Corash in the milk and food sanitation service have been the early application of concepts of sanitation as employed for milk to frozen desserts; in the utilization of thermoduric tests for quality evaluation of pre-pasteurized milk; in the application and general adoption of the phosphatase test, and in application of cryoscopic procedure. He has pioneered standards for bulk milk dispensers and washers for bulk milk tanks. In the field of professional relations he has served on committees in the development of sanitary standards and design of food handling equipment, advisory committees on ordinances and regulations, and has acted as consultant and lecturer to various public health agencies and consumer groups.

The certificate accompanying the Award presented to Mr. Corash reads as follows: "For distinguished service in contributitng to the public health welfare of the community he serves; for personalizing the ideals of the Sanitarian; for his contribution toward public recognition of the profession of the Sanitarian."

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WANTED: Recent graduate in Food Technology or one who majored in chemistry with emphasis on organic chemistry for quality control work in seasonings. **REPLY BOX 226, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.**

WANTED: Chemical Engineer or Chemist by nationally known firm. Must have some experience in field of prepared mixes involving wheat flour. Formulation and basic technical research. Location Illinois. **REPLY BOX 228, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.**

WANTED: Dairy chemist, graduate degree, background physical and biological chemistry, for research and development work with expanding milk processor. Must have initiative to assist in planning and organizing his own work. Industrial experience helpful but not required. In reply describe education, experience, state age and salary requirement. **REPLY BOX 221, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.**

CHIEF CHEMIST WANTED: By old established food processor for research and new product development. Experience in meat curing and sausage manufacturing desirable. Location Chicago. Give complete background, education, experience and salary requirements. **REPLY BOX 225, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.**

AVAILABLE: Food Technologist. Two and a half years experience. Desires position as assistant in development or research. Presently employed. **REPLY BOX 229, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.**

AVAILABLE: Chemist, Ph.D., food technologist; 20 years. Carbohydrate research, development; baking technology; technical service to bakers, food processors; supervision, laboratory, plant personnel; writing, direct mail advertising, radio, sales service. Desire constructive, growing work, industry, technological institute, publication. **REPLY BOX 230, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.**

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WORLD CENSUS OF AGRICULTURE

According to information available in October 1951, 53 countries and territories have now taken their census of agriculture within the framework of the 1950 World Census of Agriculture. The distribution of these countries by continent is as follows: 16 in Europe, 12 in North and Central America, 6 in South America, 5 in Asia, 9 in Africa, and 5 in Oceania. In the previous World Census of Agriculture taken in 1930, only 42 countries and territories took a census.

Most of the countries followed the program set up by FAO, or at least adapted the minimum list of questions to their respective conditions. In many cases some particular details were collected only by sampling methods; in certain countries, in Kenya, Nigeria, Southern Rhodesia, and Tanganyika, for instance, the whole census was carried out as a sample survey. The preliminary results of the 1950 agricultural census are now available for many countries. [From *FAO Monthly Bulletin*, 4 (10) 28 (1951) October.]

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Yeasts Occurring in Citrus Products

Research on Flexible Films for Food Packaging

The Control of Thermophilic Bacteria

Color of Capsicum Spices. I. Measurement of Extractable Color

Nutritive Value of Canned Foods. No. XLIV. Enzyme Inactivation and Ascorbic Acid Retention in Vegetables Blanched and Held Under Different Conditions Prior to Canning

Sugar and Acid Tolerance of Spoilage Yeasts from Sweet-Cucumber Pickles

Practical Application of Time and Motion Study Techniques as Used in General Foods

Some Factors Affecting the Pectin Grade of Apple Pomace

Volume VI, Index

Affairs of the Institute

December, 1952 Pages 443-484 Volume 6, Number 12